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ERRATA.

Page 17 line 24 for " *Ceratoma* " read " *Cerotoma* "
,, 29 ,, 8 delete " of *Citrus* "
,, 29 ,, 11 after " Ckll.," insert " all on *Citrus*, and "
,, 37 ,, 45 for " Fillinger " read " Filinger "
,, 58 ,, 39 ,, " *Eucosoma* " read " *Eucosma* "
,, 58 ,, 45 ,, " *Sycamus* " read " *Sycanus* "
,, 105 ,, 11 ,, " *tribolitiformis* " read " *trilobitiformis* "
,, 165 ,, 11 delete " also "
,, 166 ,, 27 for " *anachoreta* " read " *anchoreta* "
,, 187 ,, 14 ,, " Arnhardt " read " Arnhart "
,, 192 ,, 34 ,, " *Dichochrocis* " read " *Dichocrocis* "
,, 197 ,, 11 ,, " (*Pterandus*) " read " (*Pterandrus*) "
,, 201 ,, 8 ,, " Essig (L. O.) " read " Essig (E. O.) "
,, 215 ,, 11 ,, " *Pantomerus* " read " *Pantomorus* "
,, 224 ,, 31 ,, " xxvi " read " xxvii "
,, 226 ,, 38 ,, " May " read " April "
,, 242 ,, 43 ,, " [*Leptocorisa varicornis*, L.] " read " [*Leptocorisa varicornis*, F.] "
,, 328 ,, 19 ,, " Schwarz " read " Schwartz "
,, 343 ,, 14 ,, " former " read " latter "
,, 343 ,, 15 ,, " latter " read " former "
,, 361 ,, 40 ,, " *Caloodes* " read " *Calloodes* "
,, 363 3 lines from end for " (*Chaetodactus*) " read " (*Chaetodacus*) "
,, 421 line 31 for " containing " read " contained in "
,, 427 ,, 7 ,, " xvii " read " xviii "
,, 428 ,, 13 ,, " *P. praefectata* " read " *O. praefectata* "
,, 431 6 lines from end for " Fruit Fly " read " Frit Fly "
,, 489 line 36 for " *lawsoniana* " read " *lawsoni* "
,, 511 ,, 19 ,, " **1929** " read " **1930** "
,, 514 2 lines from end for " *tubifera* " read " *tuberifera* "
,, 526 2 lines from end for " Uzbekistan " read " Turkmenistan "
,, 558 line 23 for " [Hutson (J. C.).] " read " [Jepson (F. P.).] "
,, 613 ,, 6 ,, " parasites " read " hosts "
,, 634 ,, 28 ,, " can " read " cannot "

IMPERIAL BUREAU OF ENTOMOLOGY.

REVIEW

OF

APPLIED ENTOMOLOGY.

SERIES A.

Vol. XVIII.] [1930.

ROEBUCK (A.). **New Pest on Umbelliferous Crops.**—*Fruit Grower*, lxviii, no. 1766, p. 573, 2 figs. London, 17th October 1929.

The Chrysomelid, *Phaedon* (*Paraphaedon*) *tumidulus*, Germ., previously recorded from parsley and celery, has recently caused serious damage to celery [*cf. R.A.E.*, A, xvii, 674], parsnips and carrots in England. There appear to be two overlapping generations a year, and the life-history is apparently similar to that of *P. cochleariae*, F. [*cf. R.A.E.*, A, xii, 282]. Eggs and adults were found in abundance on hogweed (*Heracleum sphondylium*) during the last week of June. By July or August the hogweed has dried up and the beetles, which are gregarious and migrate in colonies, then infest cultivated umbelliferous plants until frost causes them to hibernate. They settle in large numbers on a plant and when the entire foliage has been devoured move on to the next. Sprays of 1 oz. Paris green and 4 oz. freshly slaked lime, or 8 oz. lead arsenate paste, to 10 gals. water appear to be effective, the one containing Paris green being quicker in action. The foliage, which should be thoroughly wetted by the spray, remains poisoned for 6–8 weeks.

MURPHY (P. A.) & M'KAY (R.). **The Insect Vectors of the Leaf-roll Disease of the Potato.**—*Sci. Proc. R. Dublin Soc.*, xix, no. 27, pp. 341–353, 18 refs. Dublin, September 1929.

The literature dealing with the transmission of leaf-roll disease of potato is reviewed, and a list is given of the insects found by various workers to be capable of conveying the disease either aerially or through the soil. The problems of experimental transmission and the correlation of field outbreaks with Aphids are discussed. In experimental work with Aphids extending from 1922 to 1928 [*R.A.E.*, A, xi, 92; xiv, 113, etc.], the numbers of successful leaf-roll infections secured with *Myzus persicae*, Sulz., were 19 out of 25; with *M. pseudosolani*, Theo., 2 out of 40; with *Macrosiphum gei*, Koch (*solanifolii*, Ashm.), 1 out of 151; and with unidentified Aphids, 5 out of 34. In spite of the few positive results secured, it is believed that *Myzus pseudosolani*, *Macrosiphum gei* and the Capsid, *Calocoris norvegicus*, Gmel. (*bipunctatus*, F.) may transmit infection occasionally, though *Myzus persicae* is mainly responsible for the spread of the disease.

Studies in 1928–29 of the conditions under which *M. persicae* transmits leaf-roll show that it is capable of conveying infection between plants in any stage of growth. The younger the inoculated plant, and apparently also the younger the plant providing infection, the quicker the symptoms develop on the former. This seems to be correlated with greater ease of infection in the earlier stages of growth. When both the inoculated plant and the source of infection are old, infection is rendered most difficult. The symptoms that develop first after infection vary with the age of the inoculated plant. It is possible to calculate with considerable accuracy the time at which plants have become infected with leaf-roll in the field by a knowledge of the time of appearance and nature of the first symptoms and the character of the resulting crop of the succeeding year. Infection through the sprouts before planting, which produces secondary leaf-roll in the first half of June, or early field infection through the foliage, which causes the appearance in July of primary symptoms more or less rapidly passing into secondary ones, usually results in a totally diseased crop. In the case of later infections, which may produce primary leaf-roll that persists for the season or cause no alteration in the outward appearance of the plants, some of the tubers remain healthy, a condition, however, that may also follow sprout infections. The first reaction after infection is also affected by the variety of the plant, some varieties showing primary symptoms more readily than others.

KÄSTNER (A.). **Untersuchungen zur Lebensweise und Bekämpfung der Zwiebelfliege** (*Hylemyia antiqua* **Meigen**). **III. Teil.** [Investigations on the Biology and Control of the Onion Fly, *H. antiqua*. Part III.]—*Z. PflKrankh.*, xxxix, nos. 8–9, 10–11, pp. 347–366, 369–385, 5 figs., 8 refs. Stuttgart, 1929.

This is the final part of an account of investigations on *Hylemyia antiqua*, Mg., a serious pest of onions in the district of Calbe, Saxony [*R.A.E.*, A, xvii, 460, 686], and deals with the measures to be adopted. The onion seed is drilled in March, and onions are harvested early in September. Infestation by *H. antiqua* results in a withering of the tips, followed by the death of the plants, and the larvae migrate underground to neighbouring plants, so that gaps occur in the rows. The injury becomes apparent in June, when the plants are 3–6 ins. high, and steadily increases until about mid-July, after which the remaining plants are left more or less untouched until the harvest, as the onions are large enough for the larvae to mature in them without migrating. The damage caused by the summer generation is therefore much less serious than that done by the spring one, though it is sometimes of considerable importance. The quality of the crop is adversely affected, because the remaining plants being thinned out, their leaves do not dry up and " thick neck " onions of inferior value result. The properties of the soil do not appear to influence infestation, but small plants are preferred for oviposition, and ovipositing females may be carried by wind. The various measures advocated against *H. antiqua* are reviewed, and an account is given of the author's own work. The cultural measures advised are drilling good seed in abundance and proper manuring. When the fields are ploughed in spring, fowls are of considerable value in destroying the pupae. Repellents and insecticides for destroying the eggs or larvae did not prove promising for practical use, and onion plants were not effective as traps, though

this method may be of value in other regions. Deep ploughing, often recommended against the pupae, also gave poor results. In gardens and small plots a certain number of flies can be caught on sticks smeared with adhesive. A bait-spray containing 3 per cent. molasses and 2 per cent. sodium fluoride or sodium arsenite proved very attractive to the adults, but the actual effect achieved cannot be observed until the spring of 1930.

HAHMANN (C.). **Rote Spinne im Gewächshaus und ihre Bekämpfung mit Cyanogas.** [Red Spider in Greenhouses and its Control with Cyanogas.]—*Z. PflKrankh.*, xxxix, no. 10–11, pp. 386–389, 8 refs. Stuttgart, 1929.

In experiments, calcium cyanide even at dosages harmful to the plants (300 gm. per 100 cu. m.) did not kill red spider [*Tetranychus*] in greenhouses. Further tests will be made with heavy oils as sprays preceding fumigation.

WESSELY (E.). **Die Bekämpfung der Nonne mit besonderer Bezugnahme auf eine entsprechende Wertung der uns bekannten Kampfmittel.** [The Control of the Nun Moth with particular Reference to an adequate Utilisation of the known Measures.]—*Centralbl. ges. Forstw.*, 1928, p. 49. (Abstract in *Z. PflKrankh.*, xxxix, no. 10–11, p. 416. Stuttgart, 1929.)

Early recognition of an impending outbreak of the nun moth [*Lymantria monacha*, L.] is of great importance in order that the conditions under which the increase is taking place may be ascertained. This enables the measures taken to be adapted to any natural factors of control that may be active at the time. Banding of the trunks should be done promptly, and its value is greater when bad weather forces the moths to fly and oviposit near the ground. This measure should not be employed if polyhedral disease is prevalent.

JANCKE (O.). **Zur Frage der Ueberwinterung der Blutlaus und ihres Parasiten *Aphelinus mali* Hald.** [The Hibernation of the Woolly Aphis and of its Parasite, *A. mali*.]—*NachrBl. deuts. PflSchDienst*, ix, no. 10, pp. 83–85, 1 graph. Berlin, October 1929.

Eriosoma lanigerum, Hausm. (woolly apple aphis) hibernates on all parts of the tree, though in very severe winters only the sheltered individuals on the roots survive. This has led to the erroneous belief that the Aphid seeks hibernation quarters on the roots. The use of adhesive bands [*R.A.E.*, A, xvii, 583] is therefore of value only in severe winters, and even then may prove ineffective, owing to the difficulty of ensuring close contact with the bark. The results of observations at Naumburg in the winters of 1926–27, 1927–28 and 1928–29 are given in full. It was found that the colonies on the bark can survive temperatures of $-17°$ C. [1·4° F.] but are all killed at $-32°$ C. [$-25·6°$ F.], so that the critical point lies between these temperatures. Twigs infested with woolly aphis parasitised by *Aphelinus mali*, Hald., were placed in autumn 1928 on apple in the open at Naumburg, and in April and June 1929 the Chalcid was found to have survived the winter, which was very severe.

Fuchs (G.). **Die Parasiten einiger Rüssel- und Borkenkäfer.** [The Parasites of some Weevils and Bark-beetles.]—*Z. Parasitenk.*, ii, no. 2, pp. 248–285, 36 figs., 25 refs.

Wülker (G.). **Bemerkungen zur Arbeit von G. Fuchs: "Die Parasiten einiger Rüssel- und Borkenkäfer."** [Remarks on G. Fuchs' Work.] —*T.c.*, pp. 286–290, 1 fig.

Fuchs (G.). **Nachschrift zu Wülker's Bemerkungen.** [Postscript to Wülker's Remarks.]—*T.c.*, pp. 291–293. Berlin, 12th October 1929.

The Nematode parasites, including several new species, of various weevils and bark-beetles in Central Europe are described in the first paper, followed by some discussion on their classification in the other two.

Malenotti (E.). **Esperienze contro la Psilla del pero.** [Experiments against the Pear Psyllid.]—*Il Coltivatore*, 1929, no. 26, reprint 8 pp. Casale Monferrato, 1929.

Psylla pyricola, Först., is a serious pest of pears in North Italy. Spraying with nicotine-soap being inconvenient in some cases, experiments were made in July on fumigation with hydrocyanic acid gas by the Sansone Capogrosso method [*R.A.E.*, A, xvii, 330], excellent results being obtained with 6 gm. sodium cyanide per cu. m. Volck emulsion, when sprayed at a strength of 3 per cent., also gave good results. The relative costs of these insecticides in Italy are given.

Teodoro (G.). **Due cocciniglie parassite del gelso in Romania.** [Two Coccids infesting the Mulberry in Rumania.]—*Industria bacol.*, iii, no. 9, pp. 8–10, 3 refs. Milan, September 1929.

In some districts of Rumania, mulberry trees have been found to be more or less severely infested by *Lecanium* (*Eulecanium*) *corni* var. *robiniarum*, Dougl., sometimes associated with *L.* (*E.*) *persicae*, F. These Coccids occur on a variety of food-plants, including *Robinia pseudacacia*, which is preferred by *E. corni* var. *robiniarum*. In Rumania they survived winter temperatures as low as $-25°$ C. [$-13°$ F.].

Morris (H. M.). **Report of the Entomologist for 1928.**—*Rep. Dept. Agric. Cyprus, 1928*, pp. 43–44. Nicosia, July 1929.

Tests against *Syringopais* (*Nochelodes*) *temperatella*, Led., showed that light traps are only attractive to the males. Spraying with a solution of sulphur was found effective against *Eriophyes granati*, C. & M., on pomegranate. An insect infesting the pods of carob [*Ceratonia siliqua*] has been identified as *Asphondylia* (*Schizomyia*) *gennadii*, Marchal. A campaign has been conducted against *Dolycoris baccarum*, L., which spends the hottest part of the year under stones on the summit of a mountain, 6,400 ft. high, and causes serious damage to crops in the hill villages in the early summer. A rough survey of the incidence of *Dacus oleae*, Gmel., and *Prays oleellus*, F., throughout the island indicated that *D. oleae*, though abundant in the highest olive-growing areas, is absent from some other districts, whereas *P. oleellus* is absent at high altitudes. The fruit of wild olives growing in forest land was

also found to be heavily infested with *D. oleae*. In addition to insects mentioned in previous reports [*R.A.E.*, A, xiv, 198; xv, 15], the following have been recorded during 1928: *Leucodiaspis* (*Leucaspis*) *riccae*, Targ., on olive leaves and fruit; *Crioceris bicruciata*, Sahlb., on asparagus; *Myelophilus piniperda*, L., damaging pine trees; *Pieris brassicae*, L., and *P. rapae*, L., on cauliflower; and *Eurydema festivum*, L., on potatoes.

SUREYA (M.). **Turkey: Crop Pests.**—*Internat. Bull. Plant Prot.*, iii, no. 8, p. 117. Rome, August 1929.

The pests recorded include *Eurygaster integriceps*, Put., on wheat and barley along the Turco-Syrian frontier, the eggs of this Pentatomid being parasitised by a Chalcid; *Aulacaspis* (*Diaspis*) *pentagona*, Targ., on mulberry, etc., near Constantinople; *Tanymecus palliatus*, F., on vines near Smyrna; *Rhynchites bacchus*, L., on potatoes in the Smyrna and Brusa regions; *Scolytus mali*, Bech. (*pruni*, Ratz.), doing considerable harm to apple and cherry near Angora; *Hyponomeuta malinellus*, Zell., widely distributed on apple and plum; and *Aporia crataegi*, L., which is parasitised by *Apanteles* sp., on apple and pear near Angora. Invasions of *Dociostaurus maroccanus*, Thunb., took place along the Turco-Syrian and Iraq frontiers and in part of the province of Smyrna. Large numbers of the locusts were destroyed by the use of zinc barriers and arsenical baits. The hatching of the eggs of *Calliptamus italicus*, L., occurred early in May. This locust injures spring crops and market gardens in Thrace, Samson and Brusa.

[VINOKUROV (I. M.).] **Винокуров (I. M.). Five Years' Work of the Irkutsk Plant Protection Station (1922-26).** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 2 (5), pp. 16–24. Tomsk, July 1927. [Received 1929.]

The organisation and activities of the Irkutsk Plant Protection Station are briefly reviewed, and notes are given on the pests recorded from various parts of eastern Siberia. The Acridids, *Gomphocerus sibiricus*, L., *Chorthippus* (*Stauroderus*) *scalaris*, F. W., *C.* (*S.*) *apricarius*, L., *C.* (*S.*) *biguttulus*, L., and *C. albomarginatus*, DeG., cause enormous damage. Cereal pests include *Phyllotreta vittula*, Redtb., *Delphacodes* (*Delphax*) *striatella*, Fall., *Deltocephalus striatus*, L., *Cicadula sexnotata*, Fall., *Aelia sibirica*, Reut., *Haplothrips tritici*, Kurdj., *Contarinia tritici*, Kby., *Harmolita* (*Isosoma*) *noxialis*, Porch., *Oscinella frit*, L., and *Heliothis* (*Chloridea*) *dipsacea*, L. Vegetables are attacked by the weevil, *Sitona lineellus*, Bonsd., and the larvae of *Euxoa islandica*, Stgr., *E. adumbrata*, Ev., *E. cursoria*, Hufn., *E. cursoria* var. *saga*, Stgr., and *Agrotis* (*E.*) *ditrapezium*, Schiff. *Dendrolimus sibiricus*, Tshtv., caused severe damage to about three million acres of conifers. Campaigns organised against locusts are briefly reviewed. As regards the other pests, poison baits of bran or sawdust proved very effective against *H. dipsacea*; dusting with a 20 per cent. mixture of fine sodium arsenite and white clay killed 80–100 per cent. of the larvae of *D. sibiricus*; and injury by *Euxoa* spp. was to a certain extent checked by watering the infested vegetables with kerosene or carbolic emulsions, supplemented by hand-collection of the larvae.

[Berezhkov (R. P.).] **Бережков (Р. П.). A preliminary Review of the injurious Acrididae of western Siberia.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 2 (5), pp. 40–52, 35 refs. Tomsk, July 1927.

Up to the present 75 species of Acrididae have been recorded from western Siberia, of which the most injurious are *Gomphocerus sibiricus*, L., which in the years of outbreaks constitutes 80–90 per cent. of the total number of Acridids in the black soil steppe zone, *Chorthippus* (*Stauroderus*) *scalaris*, F.W., the principal pest of the steppe-forest zone, *C. albomarginatus*, DeG., *Arcyptera microptera*, F.W., *Calliptamus italicus*, L., and *Locusta migratoria*, L. The following are occasional or doubtful pests: *Chorthippus* (*Stauroderus*) *apricarius*, L., *Dociostaurus kraussi*, Ingen., *D. crucigerus brevicollis*, Ev., *Arcyptera fusca*, Pall., *Psophus stridulus*, L., *Oedaleus decorus*, Germ., *Celes variabilis*, Pall., *Oedipoda coerulescens*, L., *Bryodema tuberculatum*, L., and *Podisma pedestris*, L.

Notes on the local distribution and bionomics of each species are included.

[Masaïtis (A. I.).] **Масайтис (А. И.). On the Study of Elaterids in Siberia.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 2 (5), pp. 53–65, 1 ref. Tomsk, July 1927.

The economic importance of Elaterids, which are common pests of wheat, oats and rye in western Siberia, is discussed, and the work of the Siberian Regional Plant Protection Station on their biology in 1924–26 is reviewed. The genera occurring in western Siberia are *Selatosomus*, *Agriotes* and *Cardiophorus*, and about 27 species have been recorded from the Novo-Sibirsk and Kamen districts, of which the following, in order of their abundance, are the most important: *Selatosomus latus*, F., *S. spretus*, Mannh., *Agriotes sputator*, L., *A. obscurus*, L., *Cardiophorus atramentarius*, Er.(?) and *A. lineatus*, L. The adults of one species or another are on the wing from the beginning of May till the beginning of September. In 1925 and 1926 the females of *Selatosomus* were much less numerous than the males, the percentage not exceeding 6 in *S. latus* and 17 in *S. spretus*. The young beetles hibernate before emerging from the soil, and an estimate of their numbers to a given area of ground in autumn may help to forecast their abundance in the following year. In the first half of May most of the larvae occur at a depth of about 4 ins., but from the end of May till mid-June they are usually found at a depth of 2 ins., this being the period when the crops are most heavily damaged. The larvae then penetrate further into the soil, remaining at the depth of 6 ins. till the middle of September, after which they go still deeper. The best time for their control is, therefore, from the second half of May till mid-June, when they are nearest to the surface and moulting begins. The pupal stage lasts from the second half of July till mid-August, pupation occurring at a depth of about 5 ins.

Unpoisoned baits of linseed and hempseed cake, or dung, proved very effective in protecting wheat when placed close to the seed. When equal quantities of wheat and ground hempseed cake were mixed and sown at the rate of 80 lb. to the acre, only 18 per cent. of the crop was destroyed, as compared with 32 per cent. in an untreated field. In another test, when ground linseed cake, at the rate of about

470 lb. to the acre, was introduced into the soil prior to the sowing of the wheat, 54 per cent. of the latter was damaged, as compared with 64 per cent. in the untreated field. The author concludes, therefore, that it is important to introduce the bait together with the wheat. Baits of horse dung poisoned with sodium arsenite appeared to be considerably more effective than those of poisoned linseed or hempseed cake. Deep ploughing to kill the pupae may give good results when effected for a series of years, but should be applied only in combination with other measures.

Late sowing proved of value in the case of oats, only 15 per cent. of the crop being destroyed, as compared with 45 per cent. in the early sowings, but the difference in the infestation of wheat sown at various periods was negligible. The percentage of wheat destroyed was equal at densities of sowing of 50, 80 and 110 lb. of seed to the acre, so that denser sowing secures a more normal crop. Although in fields with a wide space between the rows of wheat the percentage of injury was less, the crop obtained was smaller. In wheat sown at depths of about 2 and 2½ ins. infestation was heavier at the greater depth. Certain varieties of oats and wheat proved more resistant to infestation than others, and further experiments in this connection are desirable. It is pointed out that an average infestation of 10 wireworms to 1 sq. ft. results in a decrease in the crop of about 50 per cent. The value of rooks, which feed on the wireworms during the harrowing of the fields in spring, is briefly discussed.

Dusting wheat and oat seed prior to sowing with Paris green, sodium arsenite or white arsenic in the proportion of 6 : 1000 by weight was not effective ; larger amounts of poison reduced the infestation, but at the same time considerably lowered the germination of the seed.

[Reĭnov (A. I.).] Рейнов (А. И.). **On the Question of the Intensity of the Damage caused by the Flea-beetle,** *Phyllotreta vittula* **Redtb., to Summer Wheats.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 2 (5), pp. 66–70. Tomsk, July 1927.

Observations were carried out by the Omsk Plant Protection Station from 10th June till mid-July 1926 on the injury caused to wheat by *Phyllotreta vittula*, Redtb. The adults were first observed on 5th May and were very abundant at the end of the month and in June, whereas in July, owing to rain and cold, a marked decrease in their numbers was noticed. *Chaetocnema aridula*, Gyll., *C. hortensis*, Geoffr., and *Psylliodes cupreata*, Dft., were also taken on wheat, but only in negligible numbers. Tables are given showing the effect of the injury caused by *P. vittula* on eight different varieties of wheat ; on the average nearly a quarter of the leaf surface was destroyed, and although all the varieties recovered and apparently produced a normal crop, the author considers that the injury is bound to decrease the amount of the crop.

Takeuchi (K.). **Two new injurious Sawflies from Corea.**—*Trans. Nat. Hist. Soc. Formosa*, xix, no. 103, pp. 354–356. Taihoku, Formosa, August 1929.

Hoplocampa coreana, sp. n., and *Tomostethus juglans*, sp. n., described from Korea, were reared from larvae on pear fruits and *Juglans* respectively.

KATSUMATA (K.). **Life-history, Habits and a new Method of Control of** *Euchlora cuprea*. [*In Japanese.*]—*Insect Wld.*, xxxiii, pp. 335–340. Gifu, 1929.

The Rutelid, *Anomala* (*Euchlora*) *cuprea*, Hope, is very common in Japan, where it usually has one generation a year, though some individuals require two years to complete their life-cycle. Hibernation takes place in the larval stage. The pupal stage lasts about 20 days, and the adults occur from the end of June to the middle of September and feed on the leaves of vine, persimmon, chestnut, etc. Oviposition takes place about a week after mating. The males live on an average 33 days and the females, which lay 50–250 eggs, 47. The eggs hatch in about 10 days, and the larvae feed on the roots of Graminaceae, etc., as well as on decaying vegetables. A rotted fertiliser produced from soy-beans mixed with water is attractive to the adults and may be used as a trap.

KUWAYAMA (S.). **On the Scientific Name of a** *Lema* **"Dorooi-mushi."** [*In Japanese.*]—*Kontyû*, iii, no. 3, pp. 191–193. Tokyo, 1929.

In Japan, a species of *Lema*, which is generally recorded as *L. melanopa*, L., in recent Japanese literature, is very injurious to rice, but is not found on orchard or timothy grass, wheat, etc. It pupates on the leaf, and its eggs are laid in masses. As these habits are apparently different from those recorded for *L. melanopa* in Europe, the Japanese species may possibly be distinct.

SONAN (J.). **A few Host-known Ichneumonidae found in Formosa (Hym.).**—*Trans. Nat. Hist. Soc. Formosa*, xix, no. 104, pp. 415–425, 4 figs. Taihoku, Formosa, October 1929.

The new species described are *Hymenobosmina posticae*, *Charops flavipetiolus*, *Delopia nigrifemur* and *Holocremnus posticae*, all reared from larvae of the Lymantriid, *Notolophus posticus*, Wlk. ; and *Cryptus trirrhogmaniformis* from cocoons of the Limacodid, *Monema* sp., on cherry. *Angitia* (*Dioctes*) *lineata*, Ishida, is recorded as parasitic on the Tortricid, *Eucosma* (*Cydia*) *schistaceana*, Snell. ; *Xanthopimpla kuchingensis*, Cam., on the Psychid, *Clania minuscula*, Btlr. ; *X. stemmator*, Thnb., on the Pyralids, *Diatraea venosata*, Wlk. (*striatalis*, Snell.), *Chilo infuscatellus*, Snell., *Pyrausta nubilalis*, Hb., *Omphisa illisalis*, Wlk., the Tortricid, *Eucosma schistaceana*, and the Lasiocampid, *Metanastria punctata*, Wlk. ; *X. punctata*, F., and *X. formosensis*, Krieger, on *M. punctata*, the latter also parasitising *Saturnia pyretorum*, Westw. ; *Theronia zebroides*, Krieger, on *M. punctata* and the Lymantriid, *Dasychira* (*Olene*) *mendosa*, Hb., but possibly a hyperparasite ; and *Amauromorpha schoenobii*, Vier., on the Pyralids, *Diatraea venosata*, *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), *Chilo simplex*, Btlr., *Scirpophaga nivella*, F. (*auriflua*, Zell.), and *S. excerptalis*, Wlk., and the Noctuids, *Sesamia inferens*, Wlk., and *Laphygma exigua*, Hb.

SARAIVA (A. C.). **Relatório sôbre inspecção de pomares de "citrus."** [Report on the Inspection of Citrus Orchards.]—*Bol. agríc. pecuár.*, 1929, no. 1–2, pp. 47–48. Lorenzo Marques, 1929.

Inspection of orange plantations near Lorenzo Marques, Mozambique, showed the trees to be very severely infested by *Chrysomphalus* (*Aspidiotus*) *aurantii*, Mask., *C.* (*A.*) *ficus*, Ashm., being present in small numbers, while *Aphis tavaresi*, Del Guerc., was very rare.

Ripley (L. B.). **"Froghopper" in Wattles.**—*Fmg. S. Afr.*, reprint no. 51, 4 pp., 4 figs. Pretoria, August 1929.

During the summer of 1928–29 wattles were severely damaged by a widespread "froghopper" attack, and the cultural measures already noticed [*R.A.E.*, A, xv, 330] are again recommended. Two additional measures, fertilising and intercropping, are suggested. In the case of plantations one year old or younger, the severity of attack was not appreciably lessened by fertilising, especially when the trees were thinned out into twelve foot lines, but with two-year-old trees in broadcast formation a very striking difference between fertilised and unfertilised plots was apparent, the former being almost completely protected and the latter rather badly attacked. It would appear that the fertilised trees suffer less owing to their increased canopy and possibly also to an increased resistance to the poisonous effect of the saliva injected by the insects. This advantage may not be apparent on smaller trees during a severe attack, particularly if the damage has been accentuated by early thinning into the final lines. In some instances fertilised trees have become more deformed than unfertilised ones owing to the luxuriance of the "witch's broom" growth [*loc. cit.*] caused by the vigour of the fertilised tree. It is reasonable to suppose, however, that the fertilised trees will show a greater power of recovery.

Observations on intercropping with maize showed that in almost every case where this crop grew well, excellent results were obtained in the protection of young wattles. Equally good effects have been noticed where certain weeds, particularly horse weed (*Erigeron canadensis*), grew above the young wattles, but as soon as the trees show above the tops of the surrounding maize or weeds they are attacked by the Capsid, *Lygidolon laevigatum*, Reut., and the Jassids, including *Bythoscopus cedaranus*, Naudé, that are responsible for "froghopper" damage. The beneficial effect of intercropping can be largely explained by the fact that these insects are strongly attracted to sunlight and therefore select exposed sunny branches.

Some Notes on the Pseudo-Scorpion, *Chelifer sculpturatus* **in Relation to the Honey Bee.**—*S. Afr. J. Nat. Hist.*, vi, no. 4, pp. 293–296. Pretoria, June 1929.

Suggestions having been made that the Arachnid, *Chelifer sculpturatus*, was injurious to bees in South Africa, observations were undertaken to determine the exact relations between them. It was found that this Arachnid feeds on pollen (often found on the body of the bee), on which it can exist for a long period, though the possibility that under natural circumstances it feeds on mites in the nests and hives of bees has not been excluded.

Harland (S. C.). **A suggested Method for the Control of certain Bollworms in Cotton.**—*Emp. Cott. Grg. Rev.*, vi, no. 4, pp. 333–334. London, October 1929.

The author very briefly discusses the attractiveness to bollworm moths of various types of cotton. American cottons are more readily attacked by the pink bollworm [*Platyedra gossypiella*, Saund.] than the old world types. The use of certain sterile hybrids of American and old world cottons as trap plants is suggested as a possible means

of controlling bollworms, since the young bolls are invariably shed within a week or less, and the larvae, which require older bolls to complete their development, perish in consequence.

Simmonds (H. W.). **Entomological Notes.** *Elytroteinus subtruncatus,* **Fairm.**—*Agric. J. Dept. Agric. Fiji,* i, no. 2, p. 1. Suva, 1928.

The larva of the Curculionid, *Elytroteinus subtruncatus,* Fairm., is very injurious to *Begonia* in Fiji, boring down the centres of the main stems. These die back or break off at the spot attacked, which is generally near the base. In Hawaii ginger is infested, and in the Cook Islands lemons are damaged, the larva boring in the base of the stalk and thence into the pulp, where pupation occurs.

Taylor (T. H. C.). **Parasites from Trinidad for the Coconut Scale.**—*Agric. J. Dept. Agric. Fiji,* i, no. 2, pp. 11–15. Suva, 1928.

An account is given of the transport of the Coccinellid predators of the coconut scale, *Aspidiotus destructor,* Sign., from Trinidad to Fiji [*R.A.E.*, A, xvi, 632]. The species, in their order of importance, are *Cryptognatha nodiceps,* Mshl. [which has since become well established (xvii, 734)], an unidentified spotted species, *Microweisea* (*Pentilia*) *insidiosa,* Muls., a small unidentified species and *Azya trinitatis,* Mshl., each of which is briefly described. All their life-histories are very similar, and that of *C. nodiceps* may be taken as representative. The female generally attacks a full-grown Coccid, devours part of the body contents and deposits a single egg in the space so formed. After about 5½ days, the young larva appears and begins at once to feed on the Coccid and to wander about the leaf. Scales are devoured at a great rate, and the larva matures in about 12 days. It then attaches itself firmly to the leaf or stem and pupates, the pupal stage lasting four days. The adults feed voraciously on the Coccids and can fly considerable distances in search of food. The females begin to oviposit about 5 days after emergence, so that the period between oviposition of successive generations is about 4 weeks. As the oviposition period of each individual lasts for several weeks, the generations overlap. The methods of breeding and distribution are discussed. The method of rearing now in use is to place a number of the Coccinellids (approximately 30) on a banana leaf that is heavily infested with Coccids and to enclose the leaf in a cheesecloth bag, excluding ants, etc., by a band of adhesive round the base of the leaf-stem. After about a week, during which time the beetles oviposit freely, they are removed, the bag closed up again, and the beetles enclosed on a fresh leaf. By doing this successively a large number of Coccinellids is obtained, each bag generally yielding 200–300 or more. As soon as a colony is well established in one place, some of the beetles are collected and distributed in another.

Kermack (J.). **Action taken in regard to Control of Noxious Weeds.**—*Agric. J. Dept. Agric. Fiji,* i, no. 2, pp. 9–10. Suva, 1928.

In view of the recent report from Trinidad regarding the possible value of *Liothrips urichi,* Karny, in the control of the noxious weed, *Clidemia hirta* [*R.A.E.*, A, xvi, 602], feeding experiments are to be carried out there to test the advisability of its introduction into Fiji.

The spread of *Lantana* has been considerably checked in Fiji by the introduction of *Agromyza lantanae*, Frogg., which is well distributed throughout the Islands and the value of which is not likely to increase further, and the two Lycaenids, *Tmolus* (*Thecla*) *echion*, L., and *Callicista thius*, Hb. (*Thecla agra*, Hew.), which are now established on Vitilevu and Ovalau, but are not present in sufficient numbers for distribution elsewhere. The Tingid, *Teleonemia lantanae*, Dist., is said to be so destructive to the leaves in Hawaii that seed production is considerably reduced, and arrangements are being made to import it into Fiji.

SIMMONDS (H. W.). **Lantana Bug,** *Teleonemia lantanae*, **Distant.**—*Agric. J. Dept. Agric. Fiji*, i (1928), no. 3, pp. 16–21. Suva, 1929.

In a preliminary editorial note, the successful introduction of the lantana bug, *Teleonemia lantanae*, Dist., into Fiji is recorded [see preceding paper and *R.A.E.*, A, xvii, 564]. Of the Lycaenids, *Callicista thius*, Hb. (*Thecla bazochii*, Godt., *agra*, Hew.) is now generally distributed near Suva and Levuka, but is not locally so abundant as shortly after its introduction [*R.A.E.*, A, xii, 567]; *Tmolus* (*Thecla*) *echion*, L., has been liberated on Taveuni, but whether it has become established is not known.

The author's investigation into the work of the bug in Hawaii showed that *Lantana* is much more stunted there than in Fiji, though this may be due in part to climate. Both the adults and nymphs suck the juices of the leaves and young stems and to some extent the flower buds; the leaves in consequence dry up and drop to the ground, and the production of flowers and seeds is reduced, though the plant is not actually killed. Breeding occurs freely in cages, so that transport was easy. Other insect enemies of *Lantana* in Hawaii include *Crocidosema* [*lantana*, Busck], and a gall-forming fly [*Eutreta xanthochaeta*, Aldr.]; both of these by causing dieback of the terminals induce lateral branching, which is probably largely responsible for the matted growth of the plant seen in Hawaii, so that their introduction into Fiji is not altogether desirable.

Several parasites of various insects were observed in Hawaii, some of which were also brought to Fiji. *Lamprosema* (*Nacoleia*) *octosema*, Meyr., the banana scab moth of Fiji, does not occur in Hawaii, but *L.* (*N.*) *blackburni*, Butl., and five allied species are found there on bananas or coconuts. Of their parasites an Ichneumonid, *Cremastus hymeniae*, Vier., which is probably the most likely to prove of value against *L. octosema*, occurs on all the six species referred to as well as on 20 other Lepidoptera and is sometimes extremely numerous on *L. blackburni*. Some of those imported escaped, and none was bred through. A Braconid, *Microbracon omiodivorum*, Terry, was very numerous and about 150 were liberated in Fiji. A Chalcid, *Brachymeria* (*Chalcis*) *obscurata*, Wlk., experimentally attacked the pupa of *L. octosema* and that of the cotton pest, *Sylepta derogata*, F.; as, however, it was not thought likely to increase the effect of a local Chalcid parasite of the former and might possibly attack *Ptychomyia* [*remota*, Aldr.], it was abandoned.

A few individuals of the Coccinellid, *Azya luteipes*, Muls., which destroys *Lecanium*, were liberated in an area infested with these Coccids.

Two insect enemies of nutgrass [*Cyperus rotundus*] occur in Hawaii: a moth, which may be the same as a species already in Fiji, and a beetle, which is more destructive and should therefore prove valuable [*cf.* xvi, 448].

Simmonds (H. W.). **Visit to Taveuni by Government Entomologist.**—*Agric. J. Dept. Agric. Fiji*, i (1928), no. 3, pp. 21–22. Suva, 1929.

At the end of 1928 a visit was made to Taveuni to liberate a colony of *Teleonemia lantanae*, Dist. [see preceding papers]. More than 2,000 adults and nymphs were set free. A careful search in the Island for *Aspidiotus destructor*, Sign., failed to reveal its presence, and it is suggested that every care should be taken to prevent its importation, especially in the roots of kava [*Piper methysticum*] from Vanualevu, where it is very abundant.

Simmonds (H. W.). **Some Experiments to ascertain the Part played by Flight in the Dispersal of the Banana Borer** *Cosmopolites sordidus* **in Fiji.**—*Agric. J. Dept. Agric. Fiji*, i (1928), no. 3, pp. 22–26. Suva, 1929.

Cosmopolites sordidus, Germ. (banana borer) is the most serious pest of bananas in Fiji, the beetles breeding in old stumps and spreading to the corms of the green trees of the same clump. In planting new areas, therefore, uninfested suckers only should be used, and experiments described in this paper have been undertaken to determine how long a nursery can be expected to remain free from infestation by migrating weevils from neighbouring areas. Experiments in the field and in specially prepared trays indicate that although flight probably does occur at times, it is practically negligible as a factor in the spread of the pest. Even crawling does not occur to any extent; the weevils are sluggish and will stay where there is abundant food, so that if uninfested suckers are planted on uninfested land, a reasonable crop could be assured before the estate became seriously affected. It is concluded that new estates become infested almost entirely by means of infested suckers, but it is most difficult to obtain borer-free suckers by any mechanical means.

Rodda (T. E.). **Stationary Spraying System for Vineyards.**—*N.Z. J. Agric.*, xxxix, no. 2, pp. 94–96, 1 fig. Wellington, N.Z., 20th August 1929.

An account is given of a stationary spraying system [*cf. R.A.E.*, A, xv, 182] as used in a vineyard in New Zealand during the last two years, and the method of operating it. An electrically driven plant attached to a three-cylinder pump having a capacity of 16 gals. a minute at 500 lb. pressure gave the most satisfactory results.

Box (H. E.). **El efecto producido en la composición individual de las cañas de un surco por la infestación del Taladrador** (*Diatraea saccharalis*, **Fabr.**). [The Effect on the individual Composition of various Canes in a Plot of Sugar-cane of Infestation with the Borer, *D. saccharalis*.]—*Rev. ind. agric. Tucumán*, xix, no. 11–12, pp. 291–315, 3 diagr. Buenos Aires, 1929.

A detailed account is given of investigations made in Tucumán, North Argentina, on the effect of infestation by *Diatraea saccharalis*, F.,

on the amount of sugar obtained from sugar-canes (P.O.J. 2725) growing in a given plot. Canes with an average infestation (26–50 per cent. of the internodes) or a high one (over 50 per cent.) suffer a loss of sugar content up to 5 or 10 per cent. respectively, when compared with those with a slight infestation (25 per cent. or less). In canes with 61–70 per cent. of infestation the sugar content may be decreased by nearly 15 per cent.

Box (H. E.) **Observaciones sobre Taladradores de la caña de azúcar. Una plaga nueva de la caña de azúcar: El gorgojo Taladrador (Coleoptera: Curculionidae).** [Observations on Sugar-cane Borers. A new Pest of Cane, the Weevil Borer.]—*Rev. ind. agríc. Tucumán*, xix, no. 11–12, pp. 319–322, 2 figs. Buenos Aires, 1929.

In view of the importance of weevil borers of sugar-cane in various parts of the world, an examination was made of canes in the province of Jujuy, North Argentina, infested by the larvae of a Curculionid. P.O.J. 36 was chiefly attacked, the damage to the shoots being somewhat similar to that by *Diatraea* [*saccharalis*, F.]; the inner leaves wither. This weevil has also been found in Tucumán. *Diatraea* occurs in maize near the city of Jujuy, and also in *Pennisetum latifolium*, from which it has not previously been recorded. A Braconid parasite, *Microdus* sp., was fairly abundant in one locality, but the Tachinid, *Paratheresia signifera*, Towns., was not numerous.

de Campos Novaes (J.). **Quadro synoptico e pratico da phytopathologia brasileira.** [A synoptic and practical Table of Brazilian Phytopathology.]—*Chacaras e Quintaes*, xxxv, no. 5, pp. 425–432; xl, no. 3, pp. 282–288. S. Paulo, 1927–29.

This is an annotated list of 200 diseases and pests of economic plants in Brazil, giving the scientific name and systematic position of the injurious organism, and indicating the manner in which the plant is attacked and the remedies advised. Formulae for insecticides and fungicides are appended.

Toro (R. A.). **Algunos insectos de la Papa en Cundinamarca.** [Some Insects infesting Potatoes in Cundinamarca.]—*Rev. Ind.*, vi, no. 62, pp. 39–40. Bogota, July 1929.

Potatoes, an important crop in this district of Colombia, are attacked by various insects, the chief of which are *Cirphis* (*Leucania*) *unipuncta*, Haw., and other Noctuids, *Diabrotica soror*, Lec., and *Epitrix cucumeris*, Harris. Very brief notes are given on their habits and control.

Wehrle (L. P.). **The Clover-flower Midge** (*Dasyneura leguminicola* **Lintner**).—*Bull. Cornell Univ. Agric. Expt. Sta.*, no. 481, 35 pp., 18 figs., 3 pp. refs. Ithaca, N.Y., May 1929.

The Cecidomyiid, *Dasyneura leguminicola*, Lintn. (clover-flower midge), which appears to be generally distributed throughout the United States and Canada wherever clovers are grown, causes severe losses in the production of seed. It feeds chiefly on red clover (*Trifolium pratense*); there is a difference of opinion as to whether it attacks white clover (*T. repens*) and mammoth clover (*T. medium*), but it has

been reared by the author from alsike clover (*T. hybridum*). Brief additions to the descriptions of the egg and larva are given. There are usually two generations a year in the vicinity of Ithaca, N.Y., though in some cases only one occurs. The adults are on the wing from late May or early June (about the time when red clover begins to bloom) until the end of the month, and again from late July or early August until the first part of October. Larvae from eggs laid in late June pupate in September or in the following spring; those from eggs laid in the latter part of August or in September overwinter in the cocoon and pupate in the following spring, usually about the middle of May. Before the adult emerges, the pupa makes a hole in the cocoon and crawls to the surface of the soil. The length of the various stages was found to be as follows: egg 2·2 days; larva about 77 days in the first generation and 260 or more in the second; and pupa 15–16 days. When the pupation of the first generation larvae was delayed until the following spring, the average length of the larval stage was 332 days.

The eggs are deposited singly among the florets in green clover heads that are about a quarter or half open. On hatching, the larvae enter the florets and feed on the enclosed ovaries. When fully grown, they drop to the ground and construct a silken cocoon just below the surface, in which pupation takes place after an interval of 14 to 24 days. There is apparently a tendency for the larva to migrate from the clover heads on rainy days when the heads are moist. The injury caused by the larvae is described; infestation in the field is easily recognised by the uneven blossoming of the clover heads.

Platygaster leguminicolae, Fouts, and *Inostemma leguminicolae*, Fouts [*R.A.E.*, A, xi, 281] were reared by the author from the larvae of *D. leguminicola*, and observations on the appearance of parasitised material are given with some records of the times at which parasitism was noticed. The results indicate that the emergence of *P. leguminicolae* may be delayed until the following spring, the winter being passed within the body of the host. In two small collections of larvae, the percentage of parasitism by *P. leguminicolae* was 5·7 and by *I. leguminicolae* 2·9.

Various control methods that have been previously recommended are reviewed, and cutting in early June, feeding stock on the crop until the middle of June, and rotation of crops are regarded as the most effective.

JACOBSEN (W. C.). [**Report for 1928 of the**] **Bureau of Plant Quarantine and Pest Control.**—*Mon. Bull. California Dept. Agric.*, xvii (1928), no. 12, pp. 653–683, 1 fig. Sacramento, Cal., 1929.

The State campaign to reduce endosepsis infection in figs [*R.A.E.*, A, xvi, 319; xvii, 63] was duly carried out. Though some of the figs in storage became spoiled, and the healthy ones left were not sufficient to produce the numbers of *Blastophaga* [*psenes*, L.] required for dissemination, the control of the disease was successfully accomplished, and the work can be continued under local or county organisation.

Listroderes obliquus, Gyll. (vegetable weevil) [*R.A.E.*, A, xvii, 35] has been found for the first time on a native aster (*Aster chilensis*), which seems to be a favourite food-plant. In experiments with fumigants to destroy the larvae of the weevil in various vegetables, carbon bisulphide with carbon dioxide was used at the standard strengths for fumigation against *Phthorimaea operculella*, Zell. (potato tuber moth). Tuberous-rooted vegetables showed considerable resistance to the

fumigation, but the leafy parts were so injured that their sale value was affected. In the case of beets, the taste was impaired. In tests with ethylene dichloride even more injury was apparent, but better results might perhaps be obtained with ethylene oxide. To deal with potatoes infested with *P. operculella*, four vacuum fumigators have been established; this has proved so satisfactory that the importation of potatoes so treated into Canada and the Western States is now permitted. Vacuum fumigation tests have been made with a number of the newer insecticides with a view to determining what concentrations are liable to explosion. Carbon bisulphide in combination with nitrogen will probably overcome the difficulty of the freezing found with carbon dioxide, and commercial nitrogen is now offered at a cost that is not prohibitive. The gas seems in every way the equal of carbon dioxide in reducing the danger of explosion.

A red spider, which may be a new species, has been reported on grapes; the characteristic damage was an early attack on the foliage, causing scarring of the leaves. *Tetranychus pacificus*, McGregor, also caused trouble during mid-summer, and presented a problem because the ordinary methods of control could not be used on account of damaging the vines and leaving a residue on the fruit. *Leptoglossus* sp. (western leaf-footed plant bug) attacked pomegranates, tangerines, oranges and grapefruit and, it was feared, might be the transmitting agent of certain diseases. Good results were obtained by shaking the infested trees and allowing turkeys to feed on the bugs.

Pests intercepted from abroad during the year included *Ceratitis capitata*, Wied., *Dacus* (*Bactrocera*) *cucurbitae*, Coq. (melon fly), and *Platyedra* (*Pectinophora*) *gossypiella*, Saund., from Hawaii; *Cydia* (*Laspeyresia*) *splendana reaumurana*, Hein., in chestnuts, and *Chilo* sp., in rice straw, from Japan; *Aleurocanthus woglumi*, Ashby, on *Citrus* from Costa Rica; the termite, *Coptotermes formosanus*, Shiraki, which was doing considerable damage to the woodwork in a ship; *Dialeurodes citri*, R. & H.; and the mango weevil, *Cryptorrhynchus* (*Sternochetus*) *mangiferae*, F. The increasing numbers of the Coccid, *Chrysomphalus dictyospermi*, Morg., have resulted in the enforcement of strict inspection of plant material from the Southern States, and such plants as palms with imbricated leaf bases are required to be fumigated with hydrocyanic acid gas as a precautionary measure. Drastic measures have been taken to suppress outbreaks of *Dialeurodes citri*, many dwarf *Citrus* trees having been taken up and burnt, and other infested food-plants were sprayed with the regular 2 per cent. oil emulsion.

Since the presence of the walnut fly, *Rhagoletis juglandis*, Cress., became known in California [*R.A.E.*, A, xvii, 228, 385], a special problem has been the treatment for walnuts with part of the husk adhering to them, as such nuts may serve to spread infestation to new districts. The treatments tested included dipping in the standard walnut bleaching solution, vacuum fumigation with hydrocyanic acid or with carbon bisulphide, atmospheric fumigation with hydrocyanic acid, hot water treatments at temperatures from 110 to 125° F., hot air and steam. Some of the tests are not yet complete; others, particularly vacuum fumigation, sometimes gave 100 per cent. mortality. Exposure to hot air at 112° F. for 15 hours also gave 100 per cent. mortality; this is applicable to green nuts only, as the treatment affects the kernels of dried nuts. Hot vapour at a maximum of 210° F. for 100 seconds seems promising against pupae below the husks; this might be practicable in packing houses.

Galerucella luteola, Müll. (elm leaf beetle) has spread considerably since its appearance in California ; the spraying of shade trees, although requiring more powerful equipment than orchards, is considered economically practicable.

Balduf (W. V.). **Hibernation of the striped Cucumber Beetle (Coleop. : Chrysomelidae).**—*Ent. News*, xl, no. 8, pp. 260–262. Philadelphia, Pa., October 1929.

Adults of *Diabrotica vittata*, F., were discovered in hibernation in Illinois in January 1929. Two groups of about 30 beetles each were found within a few feet of each other under fallen leaves on the southern slope of a hill near the edge of some woods, but a thorough examination over an area of an acre surrounding this spot failed to reveal any more. Further details of the topographical and climatic conditions under which the beetles were found are given. The nearest cultivated cucurbits were a small patch of watermelons about ¼ mile distant, others being more than a mile away. An open pasture and two small fields of maize separated the cucurbit field and the hibernation quarters. It is presumed that the beetles are gregarious in hibernation ; the possible factors governing the choice of hibernation quarters are discussed.

Huckett (H. C.). **Control Measures for Cucumber Beetles.**—*Tech. Bull. New York Agric. Expt. Sta.*, no. 148, 82 pp., 12 refs. Geneva, N.Y., March 1929.

An account is given of experiments conducted in Long Island from 1923 to 1928 against *Diabrotica duodecimpunctata*, F., and *D. vittata* F., on cucumbers to test the efficiency of dust and spray mixtures in plant protection, as indicated by yield and growth ; and in view of the fact that spray and dust deposits merely repel the beetles, to test the value of various means of killing them, especially of nicotine dust. Previous work on the control of these beetles is briefly reviewed.

As repellents, arsenical spray mixtures, particularly those containing casein-lime, caused less injury than other materials, but their use after the early stages in the growth of the plants is usually uneconomical. Hand dusting, especially with calcium arsenate and gypsum, 1 : 15, is considered the cheapest and quickest method. As the protection afforded by dusts is only temporary, frequent applications are necessary, and when dusts containing hydrated lime were used, the growth and yield of the plants were considerably affected. Nicotine and hydrated lime dust and Bordeaux mixture (2 : 6 : 50) were toxic to the beetles as well as active repellents, but their use on the main crop as insecticides was found to be impracticable, on account of the necessity for heavy and frequent applications, which caused severe injury to the plants. Moreover, the beetles are protected from the contact action of nicotine by the foliage, and in damp weather many of them recover from its effect. Trap crops of squash seedlings in rows among the main crop were therefore used for attracting them after they had been successfully repelled from the latter. The beetles on the trap plants were destroyed by nicotine dust or in damp weather by the use of a blow torch. The importance of frequent and thorough dusting of the main crop is pointed out. Beetles were not easily repelled after the plants had begun to blossom.

EDDY (C. O.) & CLARKE (W. H.). **The Mexican Bean Beetle, 1927-1928.**—*Bull. S. Carolina Agric. Expt. Sta.*, no. 258, 41 pp., 17 figs., 7 refs. Clemson College, S.C., June 1929.

An account is given of the distribution and economic status of *Epilachna corrupta*, Muls. (Mexican bean beetle) in South Carolina, where it has been spreading in 1927 and 1928, together with the results of further work on its bionomics [*cf. R.A.E.*, A, xv, 401 ; xvi, 457]. A table showing the length of the stages of development of the three generations is given. On an average the incubation period lasted 6·69 days and the larval stage 17·01, complete development requiring about 33. The preoviposition period of the first and second generations averaged 9 days, whereas in the case of the third generation it was at least 20. The egg-laying period lasted from May until the end of September, the peak of oviposition being reached about the middle of August. The average longevity of females of the first generation was 47 days and of males 27. Overwintered females and males lived on an average 31 and 18 days respectively after emergence in the spring.

In 1926–27, detailed studies on the hibernation of *E. corrupta* were carried out in special cages, which are described. It was observed that the mortality among the beetles that become active in March and April on warm days and subsequently resume hibernation was very high. Emergence was most abundant early and late in May [*cf.* xvi, 402].

Injury to beans, soy beans and cowpeas by *Ceratoma trifurcata*, Forst. (bean leaf beetle), all stages of which are described or figured, is often mistaken for that caused by *E. corrupta*. The eggs of *C. trifurcata* are laid on or near the stem of the food-plant just beneath the surface of the soil. The maximum number deposited by one female was 1,386. The larvae feed on the roots in the soil, where pupation takes place. Hibernation is passed in the adult stage. The nature of the injury is described ; cowpeas are seriously damaged late in the summer or in the autumn, especially during a dry season.

Owing to continuous rain and frequent changes of temperature, the season of 1928 was unusually unfavourable for controlling *E. corrupta*, and serious injury to the crop was caused by very dilute mixtures of magnesium arsenate and of calcium arsenate, neither of which had previously caused any damage to plants. Quickly acting poisons such as pyrethrum soap sprays, which kill the beetles by contact, are recommended for use in such weather. Experiments with pyrethrum soap and calcium fluosilicate compound are briefly reviewed. The latter showed no marked superiority over other poisons commonly used. Various insecticides for controlling *E. corrupta* [xvii, 619] and machinery and methods for applying them are discussed. Two applications a week are recommended when infestations are high.

SEVERIN (H. H. P.). **Yellows Disease of Celery, Lettuce, and other Plants, transmitted by** *Cicadula sexnotata* **(Fall.).**—*Hilgardia*, iii, no. 18, pp. 543–582, 6 pls., 15 figs., 11 refs. Berkeley, Cal., February 1929.

Outbreaks of yellows, a virus disease transmitted by *Cicadula sexnotata*, Fall. [*R.A.E.*, A, xv, 284], were first observed on celery in California in 1925, and in 1927 in one part of the State injury estimated at 5 per cent. of the crop was caused to 7,000 acres of celery valued at

over £600,000. In 1928 the damage was probably twice as great. Asters also first became infected in 1925, and during the next three years the disease spread rapidly through the middle and south of the State. The geographical distribution of the disease and the history of its spread are discussed. Since *C. sexnotata* was present in California long before yellows became established, it is thought that the latter was probably introduced in plants from adjacent States.

Cereals are immune from infection, and for experiments non-infective leafhoppers were reared on wheat or barley. Leafhoppers fed for 2 or 3 weeks on diseased celery transmitted the disease to healthy plants, in which the incubation periods averaged from 22·7 to 105 days, the shortest ones occurring late in May and in June. Infection is not uniformly distributed in a field of celery, sometimes being more abundant along the margins, or sometimes occurring in several adjacent plants in a row, etc. Plantain (*Plantago major*) growing between the rows of celery in one locality was found to be naturally infected, and leafhoppers experimentally transmitted the disease from it to celery, nymphs and adults being common on both plants in the field. All attempts to transmit the disease by inoculating celery with the juice extracted from naturally infected plants have failed.

The disease was transmitted by leafhoppers from celery to asters (*Callistephus chinensis*) and from asters to celery. The symptoms occurring in celery, asters and plantain are described. Yellows also occurs on other flowering plants such as zinnias (*Zinnia elegans*) and African marigold (*Tagetes erecta*).

A disease of lettuce (*Lactuca sativa*) known as white heart, the symptoms of which are described, is considered to be identical with aster and celery yellows. It was transmitted by leafhoppers to healthy lettuce, celery and asters.

A description of *C. sexnotata* and an account of its geographical distribution are given. It is a pest of forage and garden crops, cereals, particularly oats, and flowering plants in various parts of the United States. A list of plants on which it will live and reproduce, given in a paper already noticed [*loc. cit.*], is quoted. It was observed that the mortality of *C. sexnotata* on old celery is very high, but that it is able to complete its life-cycle on the young plants. It hibernates in the adult stage in California [*cf. loc. cit.*] ; nymphs in the last instar were found in the field in February.

Curly-top is not transmitted by this leafhopper, and it is unable to complete its life-cycle on beet. During an outbreak in 1925, *Eutettix tenella*, Baker, was occasionally found on celery ; no outbreaks of curly-top on celery, however, have been observed to occur in nature. In some experiments the disease was transmitted to celery and back to beets by *E. tenella*, but asters and lettuce proved immune, and the beet leafhopper was unable to complete its life-cycle on them, or to transmit yellows disease. Other insects found on celery were *Agallia californica*, Baker, *A. cinerea*, O. & B., and *Empoasca flavescens*, F.

Dobroscky (I. D.). **Is the Aster-yellows Virus detectable in its Insect Vector?**—*Phytopathology*, xix, no. 11, pp. 1009–1015, 1 fig., 11 refs. Lancaster, Pa., November 1929.

The following is taken from the author's summary : A study of smears of virus-bearing insects did not reveal any visual evidence of the presence of the aster-yellows virus in *Cicadula sexnotata*, Fall. The

mycetome is evidently not concerned in the problem of the virus-carrying ability of the insect [*cf. R.A.E.*, A, xvii, 643]. An intensive study of the salivary glands and alimentary tract of *C. sexnotata*, with a view to finding the causative agent or any lesions that might be due to its presence, did not reveal any organism that could be considered of etiological significance.

STARRETT (R. C.). **A new Host of Sugar-beet Curly-top.**—*Phytopathology*, xix, no. 11, pp. 1031–1035, 1 fig., 2 refs. Lancaster, Pa., November 1929.

Experiments showed that curly-top can be transmitted from sugar-beet to *Oxalis stricta* and *vice versa* by *Eutettix tenella*, Baker.

Owing to the reported transmission of a disease of sugar-beet resembling curly-top in Argentina by leafhoppers of the genus *Agallia* [*R.A.E.*, A, xv, 458], two species that had been found on beets in Virginia, *A. constricta*, Van D., and *A. sanguinolenta*, Prov., were also tested, but both failed to transmit curly-top.

SEVERIN (H. H. P.). **Additional Host Plants of Curly Top.**—*Hilgardia*, iii, no. 20, pp. 596–636, 4 pls., 25 figs., 9 refs. Berkeley, Cal., March 1929.

This paper supplements a previous record [*R.A.E.*, A, xvii, 26]. Curly-top infection occurred naturally in a number of plants belonging to the families Solanaceae, Cruciferae and Umbelliferae, and was produced experimentally in these and other plants of the same families and also in certain cultivated plants of the families Polygonaceae, Malvaceae, Linaceae, Boraginaceae and Valerianaceae.

BARBER (G. W.). **Heat and Time of Exposure necessary to kill Larvae of the European Corn Borer in Ear Corn.**—*Circ. U.S. Dept. Agric.*, no. 71, 13 pp., 4 figs. Washington, D.C., June 1929.

An account is given of experiments to determine the temperature necessary to destroy the larvae of *Pyrausta nubilalis*, Hb. (European corn borer) in ears of maize. The hibernating larvae are usually found in the centre of the cob, which is a poor conductor of heat. The heating apparatus used is described. At constant temperatures of 68° C. (154·4° F.) exposed larvae were killed in 5 minutes, and at 54° C. (129·2° F.) in 15 minutes, a lower temperature being ineffective in killing them. A further series of tests was carried out with larvae that had been kept at 12, 10 and 23° C. [53·6, 50, and 73·4° F.]. The time taken to kill them ranged from 4–6 minutes at 66° C. (150·8° F.) to 8–10 minutes at 58° C. (136·4° F.). To determine the time required for heating the ears to obtain the necessary temperature in the centre of the cob, temperature readings were obtained by inserting a special thermometer about the thickness of a larva into the larval burrow in the ear. The rise of temperature within the cob was quite rapid during the first hour, much slower during the second hour and thereafter was very slow indeed. Well-dried ears were better conductors of heat than moist ones. After heating one variety of maize for two hours at 60° C. (140° F.), the temperature within the cob had attained 54° C.

It seems probable that two hours at 60° C. might not be entirely effective. After 2 hours at 70° C. (158° F.) the temperature within the cob had risen to 62° C. (143·6° F.) and had registered a temperature of 60° C. for about 35 minutes, which would result in the death of all the larvae. Heating a mass of the ears in a basket is not satisfactory; the best results were obtained by placing them in single layers on trays with wire netting bottoms, arranged in a frame, one above the other at intervals of 4 inches. Extensive tests were made with three types of maize, and it is concluded that the exposure necessary to kill the larvae in ears of any type of thoroughly dried maize at temperatures not injurious to the grain are 2½ hours at 68° C., 3 at 66, 5 at 63 (145·4° F.), 8 at 60, and 24 at 58. The period is calculated from the time the chamber regained the required temperature after the insertion of the maize. The larvae are more rapidly killed in the spring, when nearing pupation, than earlier in the hibernating period.

[SEVERIN (H. C.).] **Entomology.**—*Ann. Rep. S. Dakota Agric. Expt. Sta. 1927–28*, pp. 16–19. Brookings, S.D. [? 1929].

Further work against the black field cricket [*Gryllus assimilis*, F.] in fields of lucerne in South Dakota confirmed the value of cultural practices for destroying the eggs [*R.A.E.*, A, xiv, 285]. Against the adults and nymphs a bait of 100 lb. bran, 4 lb. sodium fluosilicate, 2 U.S. gals. molasses and 11–13 U.S. gals. water (this amount being sufficient for 10 acres) should be scattered in the afternoon, preferably after rain has fallen or irrigation has been carried out. It gives about 70 per cent. control, so that two applications are necessary. Continued experiments were carried out with paradichlorobenzene dissolved in liquefied paraffin wax against the larvae of *Aegeria* (*Synanthedon*) *pictipes*, G. & R., in plum trees [*R.A.E.*, A, xvi, 637]. The treatment appears to be effective, but as the paraffin tends to become brittle and flake off from the trees during a sudden drop in temperature, beeswax should be added at the rate of 1 part to 5 parts paraffin.

It was found by placing cages over sweet clover that a larger percentage of seed was set where insects had access to the flowers. Although the honey-bee is one of the most important pollinating agents, it is not essential to a good seed crop if other insects are abundant.

[**Mediterranean Fruit-fly.**]—*Mon. Bull. California Dept. Agric.*, xviii, no. 7, pp. 379–419, 12 figs. Sacramento, Cal., July 1929.

This series of 12 papers by various authors and 6 unsigned notes deals with the appearance of *Ceratitis capitata*, Wied., in Florida, its possible spread in the United States and the measures taken to prevent its introduction into California [*R.A.E.*, A, xvii, 443, 509–511, 620, 661–663].

H. J. Quayle in one of these papers enumerates the more important genera of fruit-flies, together with some of the species, and points out that the two of economic importance in California are *Rhagoletis juglandis*, Cress. (walnut husk fly) and *Epochra canadensis*, Lw. (currant fly). The serious results likely to follow the introduction of *C. capitata* into California are emphasised, and the dependence of the severity of attack on climate and a sequence of host fruits is indicated. All stages are briefly described, and a short account is given of the

method of oviposition, habits of the larvae and pupation. As many as 800 eggs may be laid by a single fly, the life-cycle is completed in 3 weeks in summer, and the number of generations varies from 4 or 5 to 10 or 12, according to the climate.

The quarantine and patrol measures introduced in Florida for checking the spread of *C. capitata* are described by J. P. Coy, and Canadian legislation against its introduction is quoted [xvii, 530]. An account is given by H. J. Ryan of the surveys of the area of infestation carried out in Florida, and the method of inspection work adopted there is outlined by A. H. Call.

A. E. Bottel, in a paper on disinfection as applied in the fruit-fly area in Florida, states that 75–85 per cent. of the fruit in an orchard of about 50 acres was found to be infested. The number of larvae in a fruit ranges from 4 to 30, or even as many as 72. In addition to methods already noticed [xvii, 510] for the destruction of fruit liable to harbour the fly, bait-sprays containing lead arsenate [xvii, 662] have proved successful in destroying numbers of flies, which are attracted to the sweet syrup when no fruit is available. In hot weather the spray remains effective for about 10 days, but during rainy periods it is necessary to spray once a week. Soil sterilisation against the pupae has been abandoned, since the pupal stage only requires 7–10 days and it is impossible to cover the infested area in that time; moreover, there is no specific time when most of the fruit-flies will be in that stage. Delivery and fruit trucks passing in and out of infested areas and all fruit stalls have to be screened, and motor cars are stopped and sprayed with kerosene, pyrethrum or other insecticide, applied by means of small atomisers. This spraying has recently been extended to all baggage carried on trains. Various methods and types of equipment used for the destruction of fruit are described by P. V. Harrigan.

The important problem of destroying the numerous alternative food-plants or host fruits of *C. capitata* is discussed by R. R. McLean. Practically all the sub-tropical fruits grown in Florida are known to be possible food-plants of the fly, and susceptible vegetables include some of the important crops. Among *Citrus* plants, the order of preference in Florida appears to be sour oranges, grapefruit, tangerines, and sweet oranges. The larvae have been taken in practically all the commercial varieties of *Citrus*, in peaches, guavas, and at least three species of *Eugenia*, *E. edulis*, *E. jambos* (rose apple) and *E. uniflora* (Surinam cherry), and in *Passiflora incarnata* and *Malpighia glabra* (Barbados cherry). Sour oranges, guavas and *P. incarnata* are very abundant in wild thickets, some of which are almost impenetrable. Possible hosts that are widely distributed include wild persimmons, wild grapes, lemon guavas, several species of small fruiting cacti and *Chrysobalanus* spp. The possibility of the utilisation of the fruits of palms by *C. capitata* for the maintenance of its life-cycle is discussed, and the difficulty of controlling the fly if it infested them is indicated. A list of about 180 recorded food-plants of *C. capitata* is given.

T. D. Urbahns, in giving an account of the spread of the fruit-fly, states that within a month of the discovery of the first larvae in Florida on 6th April 1929, 550 properties were found to be infested. The infestations extend 150 miles from north to south, and from the Atlantic to the Gulf coast, a distance of 125 miles. Natural flight or wind can hardly have been responsible for so rapid a spread, and the transportation of infested fruit is probably the most important factor in the

distribution of the fly. The local spread was aided by the practice of accumulating heaps of unsaleable fruit for use as a fertiliser. As the greater portion of the crop had been shipped before the presence of the fly was discovered, the probability that it has spread outside Florida is great.

In support of the theory that *C. capitata* had not been in Florida more than two years and possibly only for a single season previous to the present heavy infestation, it is pointed out that infestations in sour oranges, which have no commercial value, might easily have passed unnoticed and that large numbers of the fly could have been produced in them. Moreover, the mild winter of 1928–29 was favourable to the fly, and owing to the fact that fruit shipments were delayed for three or four weeks, there was time for it to complete a life-cycle before the first infestation was found in early April. Another generation undoubtedly developed before the end of May, increasing the chances of spread by natural means as well as by the movement of fruit.

Administrative Instructions concerning Mediterranean Fruit Fly Quarantine.—*U.S. Dept. Agric., P.Q.C.A.*, [Circulars nos.] 251 & 252, multigraph, 2 pp. Washington, D.C., 1929.

Under these instructions the State Plant Board of Florida is authorised to release from the designation "infested area" all areas hitherto determined as infested by the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], except those within which infestations have been determined subsequent to 31st July 1929. The effect of this is that the regulations remaining in force in these areas are only those applying to eradication areas in general [*R.A.E.*, A, xvii, 661].

The following method of sterilising grapefruit is authorised : Heating the fruit, in connection with the usual colouring process, to 110–115° F. in the approximate centre of the fruit, and maintaining this temperature for 8 hours.

Walley (G. S.). **Descriptions of new Canadian Parasitic Hymenoptera.**—*Canad. Ent.*, lxi, no. 8, pp. 190–194. Orillia, Ont., August 1929.

Among the new species described are *Angitia incipiens*, thought to be a parasite of the larvae of the Mediterranean flour moth [*Ephestia kühniella*, Zell.], as five adults were obtained in a room adjoining one in which this moth was being reared, and the Mymarid, *Polynema pratensiphaga*, found, fully developed, in the eggs of *Lygus pratensis*, L., both in Ontario. A key to the Canadian species of *Angitia* is given.

Gibson (A.) & Twinn (C. R.). **Household Insects and their Control. (With a Chapter on Animal Pests other than Insects.)**—*Bull. Dept. Agric. Canada*, N.S. no. 112 (Ent. Bull. 30), 84 pp., 1 pl., 90 figs. Ottawa, June 1929.

This bulletin gives useful information regarding household insects, including those that attack man, as well as those that damage clothing and furniture, food-stuffs and other stored products, woodwork, etc., with practical recommendations for their control.

Carroll (J.). **Tests with winter Sprays for the Control of Red Mite on Apple.**—*J. Dept. Agric.* [*Ireland*], xxix, no. 1, pp. 86–90, 5 refs. Dublin, 1929.

As infestation of apples by *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) has increased considerably where tar-distillate sprays are used [*cf. R.A.E*, A, xvii, 501], laboratory experiments to test the value of a number of sprays against the winter eggs were carried out in Ireland. A technique for counting with a great degree of accuracy the number of eggs on twigs, used in these tests, is described in detail. The method of counting the number of mites that hatched is also given. Tar distillates only slightly reduced the number of the eggs hatching, the best results being obtained with Volck oil and especially with lubricating oil emulsion. It is remarked that in the United States miscible oils (which were not available for these tests) have given better results than oil emulsions. In a field experiment most of the trees in an orchard where serious infestation by *P. pilosus* had occurred during the summer were sprayed about November with 3 per cent. Volk, tar distillate being applied either before or after the oil. In the spring the unsprayed trees were seriously infested, and, although some infestation occurred on the sprayed trees, on most of them the bulk of the eggs had failed to hatch.

Willaume (F.). **Les ravageurs souterrains (insectes et animaux nuisibles) et leur contrôle.**—*Rev. Zool. agric.*, xxvi, no. 12, pp. 185–201 ; xxvii, nos. 1, 3 & 9, pp. 6–8, 37–49, 133–140 ; xxviii, nos. 1 & 6, pp. 5–12, 81–89, 6 pls., 21 figs., numerous refs. Bordeaux, 1927–29.

This general review of the biology, importance and control of insects and other pests attacking the underground parts of cultivated plants in France contains keys for the identification of the various groups concerned. Details are given of the apparatus and technique employed in making observations on subterranean insects. Each of the groups, the principal species in which are enumerated, is then dealt with individually.

Suire (J.). **Note sur deux noctuelles nuisibles dans l'Hérault :** *Acronycta aceris* **L. et** *Trigonophora meticulosa* **L.**—*Rev. Zool. agric.*, xxviii, no. 7, pp. 97–108, 29 refs. Bordeaux, July 1929.

Notes, chiefly taken from the literature, are given on the bionomics of *Acronycta aceris*, L., and *Brotolomia* (*Trigonophora*) *meticulosa*, L. The former has recently caused injury to the leaves of horse chestnuts (*Aesculus* spp.) in the department of Hérault, and the latter has been observed as a pest of ornamental plants, both in greenhouses and in the open, in the neighbourhood of Montpellier, showing a marked preference for geranium and *Cineraria*. Parasites reared from these Noctuids by the author were the Tachinids, *Compsilura concinnata*, Mg., *Billaea* (*Gymnobasis*) *microcera*, Rond., *Echinomyia fera*, L., and, from *B. meticulosa* only, *Winthemia quadripustulata*, F. Control measures include hand-picking and beating the trees, and, in the case of severe infestation, spraying with an extract of pyrethrum.

SCHIMITSCHEK (E.). *Tetropium gabrieli* **Weise, und** *Tetropium fuscum* **F. Ein Beitrag zu ihrer Lebensgeschichte und Lebensgemeinschaft.** [*T. gabrieli* and *T. fuscum.* A Contribution to their Life-history and Associations.]—*Z. angew. Ent.*, xv, no. 2, pp. 229–334, 28 figs., 4 pls., 46 refs. Berlin, September 1929.

The warm, dry years since 1921 have caused an increase in the numbers of the Cerambycids, *Tetropium gabrieli*, Weise, and *T. fuscum*, F., in larch and spruce growing outside or on the borders of their zones of natural distribution in Austria. These investigations were made from 1926 to 1929, chiefly in South Moravia and Lower Austria. *T. gabrieli* usually occurred in larch, and *T. fuscum* only in spruce, weakened trees being especially attacked. A key is given to these two species, and *T. castaneum*, L., which is not dealt with here. Descriptions are given of the antennal olfactory organs, the egg, the larva, which is exactly similar in both species, the intestinal symbionts, and in the case of *T. gabrieli*, the pupa.

Mating occurs 1–2 hours after emergence, and oviposition begins about 5 days later and lasts about 14 days. The eggs, which are laid under scales and in deep cracks in the bark, hatch in 10–14 days. The average number of eggs laid was 80, and females segregated after one mating laid 20–30 fertile eggs. Repeated mating is therefore required for fertilising all the eggs. There is no difference between the larval feeding habits of the two species except in the food-plant; both prefer the lower parts of the trunk. *T. fuscum*, however, occurs also in the roots of spruce. The larval stage averages 90 or 328 days, the former when the average day temperature in July–August is about 20° C. [68° F.] and the latter when it is below that level. The pupal stage usually lasts 14 days. Both species are highly sensitive to cambium temperatures, and the production of two generations in a year depends on the occurrence of a series of average day temperatures of about 68° F. in July and early August and a small number of rainy days in July.

The important protective measures against these Cerambycids are cultural, such as planting in suitable situations, the avoidance of unmixed spruce stands outside the natural distribution of spruce, the use of natural restocking on small areas and the avoidance of clear felling over large ones, and careful tending of the stands. The economic loss due to depreciation in the value of the felled timber may be considerable.

The numbers of the beetles are considerably reduced by parasites, which are dealt with in detail. The species concerned are: *Helcon aequator*, Nees, *Xorides collaris*, Grav., and *Xylonomus brachylabris*, Kriechb., recorded from both *T. fuscum* and *T. gabrieli*; *Pyracmon xoridiformis*, Hlgr., *P. xoridoideus*, Strobl., *Xylonomus* sp., *Atanycolus initiator*, Nees, *Ephialtes planifrons*, Thoms., and an unidentified Campoplegine from *T. fuscum*; and *Rhyssa persuasoria*, L., *Xylonomus irrigator*, F., *Atanycolus denigrator*, L., *A. neesi*, Mrsh., *A. sculpturatus*, Thoms., *Pyracmon lucidus*, Clément, *Doryctes obliteratus*, Nees, and *Clistopyga sauberi*, Brauns, from *T. gabrieli*. In an attempt to promote a high degree of parasitism, felled trunks in which 20–30 per cent. of the Cerambycid larvae were parasitised were left unbarked in 1926 until the spring of 1927, all other trunks being barked before the larvae had penetrated to the woody parts to pupate. In 1927 the parasitism had risen to 50 per cent., and then trunks with over 50 per cent. were left until 1928, when the figure had risen to 70–75.

Furthermore, the infestation in 1927 was only one-third that of 1926, and that of 1928 only one-twentieth, though the latter year was dry and most unfavourable to spruce.

SCHWERDTFEGER (F.). **Ein Beitrag zur Fortpflanzungsbiologie des Borkenkäfers** *Pityogenes chalcographus* **L.** [A Contribution to the Biology of Reproduction of the Bark-beetle, *Ips chalcographus*.]—*Z. angew. Ent.*, xv, no. 2, pp. 335–427, 17 figs., 90 refs. Berlin, September 1929.

This work was originally planned to test Vogel's suggestion that the predominance of mature females of *Ips* (*Pityogenes*) *chalcographus*, L., in the feeding mines as compared with the males is due to the latter leaving the mines [*R.A.E.*, A, xiv, 504]. The morphology and histology of the generative organs are dealt with at length, and the places where hibernation occurs are discussed. The development of the larvae in winter is very irregular, depending on the situation of the tree and the resultant conditions of warmth and moisture. In the young beetles the sexes are equal in numbers, and this proportion does not change during the winter. No regular change was observed in the proportion between living and dead beetles or between living light and dark males or females. The darkening of the females in winter is more rapid than that of the males. In late autumn, young beetles of the second generation bore mines in preparation for breeding, but the sudden advent of cold prevents reproduction from beginning. These mines are called by the author hibernation or winter feeding mines, though this type of feeding is similar to that which occurs in bad weather during any period of the year. The limit between this winter feeding and feeding for breeding purposes appears to lie between 15·6 and 18·4° C. [60·08–65·12° F.]. Experiments showed that in January, March and April there is a more early emergence of sexually mature males than of females; in summer this is reversed, whereas at the beginning of winter both sexes emerged contemporaneously from spruce exposed to artificial warmth.

Spruce (*Picea excelsa*) is the chief food-plant of this bark-beetle, the range of infestation extending from the foot of the trunk to the tip of the crown. On an average, 10–16 eggs are laid by a female, this being below the average for bark-beetles. Repeated matings between the same beetles were frequently noticed, but one mating suffices to fertilise all the eggs in a normal brood mine. One male can fertilise several females. The female usually remains in the mine until oviposition is completed and does not migrate even if the male is absent. The males appear to leave the mines after about 3 weeks. The question of the supernumerary males is discussed at length, but no conclusion is reached.

The final chapter is devoted to the economic importance of *I. chalcographus*, the author disagreeing with the usual view that it is very injurious.

MENDE (—). **Lehmbrei als Schutzmittel gegen den grossen braunen Nadelholzrüsselkäfer.** [Clay Paste as a Protection against *Hylobius abietis*.]—*Deuts. Forstztg.*, xliv, 1929, pp. 386–387. (Abstract in *Zbl. Bakt.* (2) lxxix, no. 8–14, p. 310. Jena, 21st October 1929.)

Attacks by *Hylobius abietis*, L., may be prevented by dipping seedlings in a liquid paste of clay. The effect of this is prolonged by

adding quick-lime or boiled dextrine, but such a mixture should not be used in the case of plants only one year old. Properly dried, the mixture adheres for as long as three years.

KNOCH (V.). **Insektenschädlinge und deren Bekämpfung.** [Insect Pests and their Control.]—*Ent. Jahrb.*, xxxix (1930), pp. 71–90. Leipzig [1929].

This is a brief survey of various insect pests and their control, compiled from German literature.

PARFENTJEV (I. A.) & WILCOXON (F.). **Laubbeschädigung durch Spritzungen mit Kalzium-Arsenit und Kalzium-Arsenat.** [Injury to Foliage by Sprays of Calcium Arsenite and Calcium Arsenate.] —*Anz. Schädlingsk.*, v, nos. 9–10, pp. 107–112, 123–129, 9 figs., 18 refs. Berlin, 15th September & 15th October 1929.

Experiments showed that the determination of water-soluble arsenic (effected in distilled water) does not always give information regarding the relative injury to be expected from various arsenical compounds when placed on leaves. It is necessary to determine the pH value of the various sprays on the leaves at different times after spraying. Under greenhouse conditions potatoes are very resistant to calcium arsenite, and tomatos, grapes, roses and gherkins are comparatively resistant to a 2 per mille spray containing 30 per cent. of As_2O_3. Beans were found very sensitive to spraying. Commercial calcium arsenate (2 per mille) did no injury under greenhouse conditions. Calcium arsenite is more rapidly decomposed than the arsenate under the influence of the leaf-secretions and of the atmosphere and therefore causes more scorching, which is not always prevented by the addition of lime, though Bordeaux mixture, added to 2 per mille calcium arsenite (60 per cent. As_2O_3), almost entirely prevented injury even to beans under the above conditions.

FRIEDERICHS (K.). **Welche Faktoren regeln die Individuenzahl einer Insektenart in der Natur?** [What Factors regulate in Nature the Number of Individuals of an Insect Species?]—*Anz. Schädlingsk.*, v, no. 10, pp. 119–123, 9 refs. Berlin, 15th October 1929.

This is a critical review of a paper already noticed [*R.A.E.*, A, xvii, 489].

PETTEY (F. W.). **Removal of Spray Residue from Pears and Apples.**—*Bull.* [*Dept. Agric.*] *S. Africa*, no. 63, 8 pp., 2 figs. [Pretoria] 1929.

An illustrated description is given of a practical and economical equipment for treating pears and apples in a weak solution of hydrochloric acid for the purpose of removing the arsenical spray residue. The strength of the acid solution and the period of submergence of the fruit are discussed [*R.A.E.*, A, xvi, 467], with instructions for preparing the solution and precautions for avoiding injury to apples. It is remarked that the addition of 2 lb. freshly slaked or hydrated lime to every 80 gals. lead arsenate spray during the last two applications will facilitate the removal of the arsenical residue from the fruit when

harvested [*cf.* xvii, 727]. The lime should be slaked in or mixed with water, and the lime-water then poured into the spray tank through a sieve or hessian bag.

ZOLOTAREVSKY (B.). **Le lutte antiacridienne à Madagascar.**—*Agron. colon.*, nos. 139–140, pp. 193–199, 230–233, 3 figs. Paris, July–August 1929.

Madagascar has always been subject to periodic invasions of *Locusta migratoria migratorioides*, Rch. & Frm., the open grassy plains of the west coast being particularly favourable to its development. During these invasions, the locusts often attack rice, maize, sugar-cane, coconut and other palms, bananas and pineapples.

Anti-locust work is carried out in all parts of the Island under the organisation of a special Central Bureau. Mechanical means of control are considered the most suitable to local conditions, advantage being taken of the fact that bands of hoppers usually move in a definite direction. Once the direction of a moving band is established, pits are dug in front of them, and they are directed into them by galvanised iron screens. The methods in which the pits and screens are arranged are described and figured.

Since the theory of phases has been confirmed in the case of this locust in Madagascar, efforts should be made to organise the control of the solitary phase before it transforms into the migratory one.

HUSAIN (M. A.). **Annual Report of the Entomologist to the Government, Punjab, Lyallpur, for the Year 1927-28.**—*Rep. Dept. Agric. Punjab 1927–28*, pt. II, i, pp. 55–79. Lahore, 1929.

A study of the distribution of the different stages of *Earias insulana*, Boisd., on its various food-plants extending over a year (details of which are given in a table) showed that the largest number of eggs was present on hollyhock in February, the largest number of larvae on cotton in December and the largest number of adults in cotton fields in August. Alternative food-plants are *Malva parviflora*, bhindi [*Hibiscus esculentus*], sankukra [*H. cannabinus*], and *Sida cordifolia*, which was preferred. It was found that during the cotton season (August-November) the number of males is generally higher than the number of females, which are most numerous from February to May. Larvae of *Earias fabia*, Stoll, were observed in cotton fields during July and November and were common on *H. esculentus* in May and June. Notes are given on the seasonal incidence of various parasites of *Earias* spp. most of which have already been noticed [*R.A.E.*, A, xiv, 423 ; xvi, 419]. A small Chalcid was bred from a pupa of *Rhogas testaceus*, Grav. A new Tachinid parasite was bred from a cocoon of *E. insulana* from cotton in August 1927. Examination of cotton sticks made to determine the average attack of *Sphenoptera gossypii*, Cotes, during 1927–28 also confirmed the previous impression that native cottons are more liable to attack than American varieties [xv, 489]. A Chalcid and a species of *Vipio* were bred in large numbers from the larvae. Other insects found on cotton in addition to those already mentioned [xvi, 420 ; xvii, 168] included *Tarache basifera*, Wlk., *Sylepta derogata*, F., *Laphygma exigua*, Hb., the Eumolpid, *Colasposoma auripenne*, Motsch. (*pulcherrimum*, Baly), and the Acridid, *Poecilocerus pictus*, F. Observations on *Platyedra gossypiella*, Saund., show that the emergence of long-cycle moths begins when the tem-

perature of the seed heap containing resting caterpillars exceeds 70° F. The incidence of attack by this pest appears to be correlated with temperature. The optimum temperature for incubation was from 26° C. [78·8° F.] to 35° C. [95° F.], and above that temperature the eggs died. The number of days when the maximum temperature is below 95° F. during July and August, when the infestation in the cotton fields begins, was found to bear a direct relation to the intensity of the attack. The evidence collected up to the present indicates that larvae resting in fallen bolls, etc., in bolls on sticks left standing in the fields, and in food-plants other than cotton are not responsible for the re-infestation of the new cotton crop in the Punjab, which is probably due to larvae resting in cotton seed and seed cotton stored in villages, and possibly also to infested ginning factories.

The intensity of attack of various species of cane borers on different varieties of sugar-cane is shown in a table, the highest percentage of infestation being 45. *Argyria sticticraspis*, Hmps. (previously recorded as *Diatraea auricilia*, Dudg. [*R.A.E.*, A, xvii, 169, etc.]) and *Emmalocera depressella*, Swinh., damaged young cane, whereas 15–34 per cent. of the mature cane was injured by *Scirpophaga nivella*, F. Observations on the life-history of *Chilo zonellus*, Swinh. (previously recorded as *C. simplex*, Butl. [*R.A.E.*, A, xvi, 420]) show that the female always oviposits at night and lays more than 300 eggs in a number of clusters. In the case of *A. sticticraspis* the total number of eggs in different clusters varies from 156 to 295, and in that of *E. depressella* from 227 to 355. When exposed to the sun at temperatures of 41–43° C. [105·8–109·4° F.] the eggs were killed in 4 hours. With room temperatures varying from 93 to 102° F. and a relative humidity of 22-100 per cent., no effect on the duration of the egg stage was observed, hatching occurring in 4 days in the case of *E. depressella* and 5 in the case of *A. sticticraspis*, but when the eggs were kept at a temperature of 30° C. [86° F.] the period was lengthened. The average number of eggs laid by a female of *Pyrilla perpusilla*, Wlk., during April to December varied from 35 to 40, deposited in a single cluster on the lower surface of the leaves of the cane. From April to June they hatched in about 9 days and from November to December in 21–27. Under natural conditions the life-cycle was completed in 40–59 days in summer and 178–209 days in winter. The maximum number of generations in a year was four. In one locality as many as 44 per cent. of the eggs of *Pyrilla* spp. were parasitised by Encyrtids during September and October. The adults of *Dryinus pyrillae*, Kieff., a parasite of the nymphs, were active from the middle of March to December. The cocoons have been recorded from the leaves of sugar-cane and *Sorghum* throughout the year, and from January to the middle of March the parasite is almost exclusively in the pupal stage, adults emerging from the middle of March to the end of April. Negative results were obtained in an experiment to determine the relation of *Pyrilla* to sugar-cane mosaic. The Aleurodid, *Aleurolobus barodensis*, Mask., generally preferred broad-leaved, succulent varieties of cane. The eggs are usually laid on the lower surface of the leaves (the maximum number laid by a single female in September being 51) and hatch from May to June in 8 days and in September in 9–10 . In three cases the life-cycle in May and June was completed on the average in 4 weeks, whereas in September it took 45–49 days.

Notes are given on the bionomics and control of *Heliothis obsoleta*, F., and *Agrotis flammatra*, Schiff., on gram [*Cicer arietinum*], *Laphygma*

exigua on lucerne and *Scirpophaga nivella* and *Schoenobius bipunctifer*, Wlk., on rice. The last two moths were attracted to light traps. Experiments indicated that large numbers of the larvae were killed by the submersion or burial of the stubble in which they were hibernating. In one locality rice was attacked by *Hieroglyphus banian*, F.; satisfactory control was obtained by using field bags [*cf. R.A.E.*, A, xv, 358] and collecting hoppers with hand nets.

Notes are given on the life-histories of various pests of *Citrus*, including *Dialeurodes citri*, R. & H., which is preyed on by the Coccinellid, *Brumus suturalis*, F., *D. elongata*, Dozier, *Aleurocanthus woglumi*, Ashby, *Pseudococcus filamentosus*, Ckll., *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., and *D.* (*C.*) *zonatus*, Saund. By capturing the males of *D. zonatus* (which are attracted by eugenol or citronella oil) and destroying infested fruit, the attack in a mango grove was reduced from 60 per cent. in 1927 to 2 per cent. in 1928.

Daily observations on termite attack on wheat showed that the crop is usually liable to damage from the time it germinates until the middle of December. In soil treatment of wheat plots, leaves of dharek [*Melia azedarach*] at the rate of 7 tons to the acre, those of akk [*Calotropis procera*] at the rate of 9 tons and arsenic at the rate of 165 lb. reduced the attack to 0·7, 1·3 and 0·4 per cent., as compared with 8, 10 and 4·5 per cent. respectively in the untreated plots. In the case of sugar-cane, termite attack is most pronounced on the young plants and particularly before the setts have germinated. Dusting with Paris green or lead arsenate completely protected the setts but affected germination. Mercury bichloride at the rate of 0·25 per cent. reduced the attack considerably. Watering the individual plants of *Citrus* and grape vines with Paris green (1 part to 650 parts water) kept them free from attack for 37 days.

Notes are given on the life-histories of the following pests of vegetables: the Pentatomid, *Aspongopus janus*, F., and *Aulacophora abdominalis*, F., on cucurbits; *Leucinodes orbonalis*, Gn. (brinjal fruit borer) and *Euzophera perticella*, Rag. (brinjal stem borer) on brinjal [*Solanum melongena*]; and *Epilachna* spp. Observations showed that one variety of *Epilachna dodecastigma*, Muls., feeds on cucurbits exclusively, whereas the other attacks solanaceous plants, especially brinjal, and only feeds on cucurbits when in confinement.

An account is given of the campaign against the kutra moth [*Amsacta*] in which 512,450 moths were captured by means of 1,515 light traps over an area of 6,122 acres. Shaking the caterpillars into water covered with a film of kerosene is practicable where the crop is tall, but difficult to carry out on a large scale. Mango skins scattered over the fields attract the caterpillars, which can then be collected and destroyed.

Notes are given on the life-history of *Holcocera pulverea*, Meyr., *Eublemma amabilis*, Moore, and certain Chalcid parasites attacking lac insects.

DUTT (G. R.) & PURI (A. N.). **A simple Method of storing Food-Grains for Household Purposes.**—*Agric. J. India*, xxiv, pt. 4, pp. 245–250. Calcutta, July 1929.

Wheat stored at Pusa in 1925 in carefully sealed kerosene tins, into each of which six cow-dung balls containing a small drop of mercury had been introduced, remained throughout the storing season immune from insect injury, although stored wheat in the neighbourhood

suffered severely from attack by *Calandra* (*Sitophilus*) *oryzae*, L., and *Rhizopertha dominica*, F. A little over 1 lb. mercury is sufficient for 200 balls. Subsequent experiments on various insects confirmed the previous finding that mercury vapour acts on the eggs [*R.A.E.*, A, ix, 79]. Eggs that were almost mature were not adversely affected, but the vapour is as effective against eggs laid inside the grains as against exposed ones. In view of the possible danger to health resulting from the use of free mercury in grain stored for human consumption, experiments were made with various amalgams, the best of which proved to be a combination of two parts of tin and three of mercury rubbed together into a paste-like consistency. The tin is melted, poured over a flat surface and cut into small strips to facilitate amalgam formation. The paste is squeezed in a piece of linen and any mercury droplets that ooze out of it are removed.

Grain stored in 1927 in tins containing disks of this amalgam 3 ins. in diameter and weighing ½ oz., enclosed in a filter paper envelope placed a little below the top layer of the grain, remained free from insect attack, although adjacent to gunny bags infested with *C. oryzae*, *R. dominica* and *Tribolium confusum*, Duv. Laboratory experiments with various insects, including *Pyrilla* sp., *Scirpophaga nivella*, F., the Zygaenid, *Thyrassia subcordata*, Wlk., and a Pentatomid also indicated that this amalgam was as effective as free mercury in destroying the eggs. In 1928, untreated wheat stored in tins was badly attacked, although placed in a room where no cereals had ever been stored before. The loss of weight in a quantity of pure mercury kept with wheat for 5 months in a sealed container was only sufficient to saturate one-fifth of the total air space, so that the wheat grains themselves could not have absorbed any appreciable amount. Wheat stored under mercury vapour has been consumed by one family for over three years without any deleterious effect, and a series of tests indicated that the germinating power of the wheat was not in any way impaired.

KUWANA (I.). **A Scientific Basis for Plant Quarantine in the Countries of the Pacific.**—*Proc. 3rd Pan-Pacific Sci. Cong., Tokyo, 1926*, pp. 1124–1131. [? Tokyo, 1929.]

This brief review of the methods employed for the prevention of the transport of injurious insects, etc., from one country to another includes a suggestion of the desirability of closer international co-operation regarding quarantine work in countries bordering on the Pacific. The importance of acquaintance with foreign pests and scientific knowledge of climatic conditions is emphasised, reference being made to the precautions taken in Japan against the introduction of *Dacus* (*Chaetodacus*) *dorsalis*, Hendel, on *Citrus*, and *D.* (*C.*) *cucurbitae*, Coq. (melon fly). Both these fruit-flies come from countries warmer than Japan, and if it could be proved that they are unable to survive the Japanese climate, the restrictions in force against them could be removed. A list is given of the more important insect pests occurring in Japan, and of those the entry of which the Quarantine Bureau is endeavouring to prevent by interception.

EGGERS (H.). **Ein neuer Kulturschädling aus Ceylon.**—*Ent. NachrBl.*, ii, no. 4, p. 112. Troppau, December 1929.

The Scolytid, *Coccotrypes theae*, sp. n., is described from tea seed in Ceylon.

Ultée (A. J.). **Verslag over de werkzaamheden van het Proefstation Malang in het jaar 1928.** [Report of the Malang (Java) Experiment Station for 1928.]—*Meded. Proefst. Malang*, no. 69, 64 pp. Surabaya [1929].

Dr. Begemann, investigating the reason for differences in susceptibility of varieties of *Coffea robusta* to attack by the coffee berry borer [*Stephanoderes hampei*, Ferr.], found that the berries of various varieties have, when ripe, characteristic flavours, which are probably due to odoriferous substances in the red skin. It has not been possible to ascertain whether infestation of the berry clusters by ants influences attack by the Scolytid. It cannot breed in coffee seeds with a water-content below 19 per cent., though seeds with less water can be attacked. The imported parasite, *Prorops nasuta*, Wtrst., was never found, and its breeding was given up in the Malang districts. Against the twig-borer [*Xyleborus coffeae*, Wurth], Chalcid and Bethylid parasites were sent to places where they did not occur. The breeding and distribution of the Coccinellid, *Cryptolaemus montrouzieri*, Muls., against the white scale of coffee [*Ferrisia virgata*, Ckll.] were continued.

Zeck (E. H.) & Eastwood (H. W.). **The Banana Aphid** (*Pentalonia nigronervosa*, **Coq.**).—*Agric. Gaz. N.S.W.*, xl, pt. 9, pp. 675–680, 3 figs., 5 refs. Sydney, 1st September 1929.

A brief account is given of the bionomics and control of *Pentalonia nigronervosa*, Coq., in New South Wales, where it not only damages banana plants directly, but also transmits bunchy-top [*R.A.E.*, A, xvi, 66]. The known food-plants of this Aphid in various parts of the world are *Musa sapientium*, *M. banksi*, *M. textilis* (Manila hemp) and other species of the genus, *Alpinia rafflesiana*, *A. speciosa*, *Arum maculatum*, *Strelitzia* sp. and *Ravenala* sp. The winged and wingless viviparous females, nymph and first stage larva are very briefly described. No egg or sexual stage is known. For the control of Aphids on healthy plants, spraying with tobacco solution (25 lb. stalk or waste tobacco in 72 gals. water) or with 40 per cent. nicotine sulphate at the rate of 1 pt. to 75 gals. water is recommended; the addition of 3 lb. soap to 75 gals. of either spray ensures a more even distribution. All suckers and the soil around the bases of the plants should also be sprayed, a second application being advisable when the infestation is severe. The type of equipment is briefly discussed. Spraying should be commenced when the Aphids first make their appearance and should be continued throughout the summer and autumn, at least on those plants showing infestation.

When the Aphids are attacking plants infested with bunchy-top, they should be killed with a contact insecticide before the infected plant is uprooted, in order to prevent the escape of infective Aphids to healthy plants. For this purpose undiluted kerosene should be poured down the funnel leaf of the plant, using $\frac{1}{8}$ pt. for suckers, $\frac{1}{4}$ pt. for half-grown plants and $\frac{1}{2}$ pt. for large ones. The kerosene permeates all the leaf axils and penetrates the base of the pseudostem, killing the Aphids and after a day or so causing the leaves to fall apart and the whole plant to die off at ground level. It has little or no effect on infected corms, but under the present regulations these must be dug out. The advantage of kerosene is that less material need be

carried than when dilute tobacco or nicotine is employed, it is more easily handled and it may be kept in containers in different parts of the plantation, so that infected plants may be treated immediately they are observed.

The regulations relating to quarantined areas [xvi, 124] are given.

NOBLE (N. S.). **The Apple Leaf Jassid** (*Typhlocyba australis*, **Frogg.). Some Observations and Experiments at Bathurst Experiment Farm.**—*Agric. Gaz. N.S.W.*, xl, pt. 9, pp. 681–691, 2 figs., 1 diagr., 2 refs. Sydney, 1st September 1929.

Typhlocyba australis, Frogg. (apple leaf Jassid), which is only known to occur in Australia and New Zealand and has recently been spreading in New South Wales, causes considerable damage to apple by sucking the sap of the foliage, so that the leaves turn yellow and sometimes fall prematurely, but the most serious losses are due to the unsightly excrement deposited on the fruit, which is consequently reduced in value or rendered totally unsaleable. Apples are the only trees on which eggs were deposited and on which extensive damage was visible. Winged adults were frequently seen on pear trees adjacent to apples, but caused no apparent injury, whereas, later in the season, considerable numbers of adults found on prune trees near apples caused slight mottling of the foliage. Nymphs and adults fed freely and developed on the foliage of pear, prune and climbing rose in the insectary. All stages feed on the lower surface of the leaves. In 1928–29 two extensive generations and a very limited third one occurred during the season. Over-wintering eggs are deposited in the autumn in the fleshy tissues of the upper layers of bark, the position of the egg being marked by a small elongated swelling. Nymphs of the first brood hatched from 16th September to 8th November, and matured in 23–41 days. The adults emerged from 17th October to 8th December, the average length of life in the insectary being 20 days, although several individuals lived for 51. The eggs of the second brood are deposited in the midribs, petioles and main veins of the leaves. The nymphs hatched from 30th November to 17th February, and the nymphal period lasted 18–27 days. The adults of the second brood emerged from 22nd December to 9th March, their average length of life being 18·6 days. First and second generation adults and second generation nymphs were all present on the trees in the latter part of December and early January. The first third brood nymph hatched on 29th January, and the first adult emerged on 21st February; it is impossible to distinguish the second and third broods in the field.

Nicotine sulphate (1 : 800) with 1 lb. hard soap to 50 gals. spray and nicotine sulphate (1 : 800) combined with lime-sulphur (1 : 35) proved the most effective of the sprays tested against this Jassid; both white and red miscible oils (1 : 40) also gave fairly satisfactory control, but the red oil caused some injury to the trees. The spray should be applied to the lower surface of the leaves before the Jassids of the first generation reach the adult stage. Two applications are necessary to secure satisfactory control, the second being applied three or four weeks after the first to kill the nymphs hatching from overwintering eggs after the first spraying. These sprays can conveniently be combined with the calyx and first cover sprays of lead arsenate against the codling moth [*Cydia pomonella*, L.].

TAKAHASHI (R.). **Aphididae and Coccidae of the Pescadores.** [*In Japanese.*]—*Trans. Nat. Hist. Soc. Formosa*, xix, no. 104, pp. 425–431. Taihoku, October 1929.

Seven species of Aphids and 17 Coccids are recorded from the Pescadores Islands to the west of Formosa, including *Aphis gossypii*, Glov., on cucurbits, *A. sacchari*, Zehnt., abundant on *Sorghum*, *Phenacoccus hirsutus*, Green, which occurs in numbers on *Hibiscus*, although it is very rare in Formosa, and *Asterolecanium pustulans*, Ckll., *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.), and *Pseudococcus adonidum*, L., which are all very common. *Ferrisiana*, n.n., is proposed for *Ferrisia*, Fullaway.

KUWAYAMA (S.). **Activity of** *Lymantria* (*Porthetria*) *dispar* **Linn., in Hokkaido.** [*In Japanese.*]—*Oyo Dobutsugaku Zasshi* (*J. Appl. Zool.*), i, no. 2, pp. 106–109, 9 figs. Tokyo, 1929.

Porthetria (*Lymantria*) *dispar*, L., occurs throughout Hokkaido, where it feeds on a variety of plants. Outbreaks seem to take place at 10-year intervals and last about 5 years. The larvae migrate in masses, causing serious damage, and sometimes feed on the leaves of rice. Natural enemies include *Tachina* (?) *japonica*, Towns., *Apanteles* (*Glyptapanteles*) *japonicus*, Ashm., and *Anastatus bifasciatus*, Boy., parasitic in the pupae, larvae and eggs respectively, and a bird, *Sturnia violacea*.

KUWANA (I.). **The Rice Stem-borers in Japan.**—*Proc. 4th Pacific Sci. Cong., Java, 1929*, reprint 16 pp. [? Batavia] 1929.

An account is given of the bionomics and control of *Chilo simplex*, Butl., and *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), which are the most important insect pests of rice in Japan. All stages of these moths are described.

C. simplex also attacks *Panicum miliaceum, Zizania aquatica, Coix lacryma-jobi, Typha latifolia* and *Phragmites communis*. There are two generations a year in Korea and most of Japan, one in the north and four in Formosa, but the emergence of the adults is very irregular. The moths are nocturnal and may be caught by light-traps, particularly between 8 and 10 p.m. Females predominate until 9 p.m., after which they begin ovipositing, and the males are in the majority. The first brood of moths may live as long as 3 weeks, and those of the second up to 14 days. Mating takes place soon after emergence, and the first eggs are laid 2–3 days later. Oviposition continues for 1–2 weeks, an average of 5–6 or a maximum of 20 clusters being deposited within this period. The average number of eggs in a cluster is 50–60, and the maximum 300.

The egg-clusters of first brood adults are laid 1 or 2 inches from the tips of the leaves, generally on the upper surface, but those of the second are on the sheath of the plant and are difficult to locate. In the seed bed, first brood eggs are generally found on plants near the border, and it is therefore better not to transplant them. The egg stage lasts about a week. Shortly after hatching, the larvae disperse and find their way into the sheath ; some may migrate to other plants before entering, suspending themselves by threads and being carried by wind. The leaves break down at the point of infestation and float

on the water, and the larvae work down into the heart of the stem, and soon kill the plant, moving on to a fresh one before the death of the first occurs. A single larva may destroy 10 or more plants ; when mature it spins a cocoon, just above the water level, and pupates. The larval period varies in different localities and conditions from 24 to 56 days. The autumn larvae do not disperse immediately after hatching, most of them feeding in a cluster within the plant on which the eggs were laid. The inner surface of the sheath is attacked and begins to wither 10 days after the eggs hatch, the larvae subsequently migrating to neighbouring plants. The appearance of the infested plants, which differs according to the stage of growth, is described ; the plants are almost always killed. At harvest, the larvae are usually in the stems, 4–10 inches above the soil. Of the total larvae in a field the majority will usually be found in the straw and the minority in the stubble. If the rice is harvested in early autumn and stacked, the larvae leave the straw and enter other graminaceous plants. Hibernation occurs as a mature larva in straw or stubble ; most of the larvae pupate in the straw, but some migrate to neighbouring straw or rubbish. The pupal stage of the overwintered larvae, which occurs between mid-May and mid-June, lasts about 2 weeks, but that of the summer generation lasts only 7–8 days.

Control measures employed against *C. simplex* include hand-collection of egg-clusters and moths, collection of the moths by light-traps, delayed transplanting of rice-plants, and in the case of the second generation, cutting away the infested stems before the larvae have dispersed, 10–17 days after the maximum emergence of the adults. This should be done twice at an interval of 7–10 days. Control may be effected during the winter by storing infested straw in rooms to prevent the escape of the moths in the spring, or it may be covered in the open with a tent or matting before the time of emergence. Good results may be secured by fumigating the straw with carbon bisulphide. In heavily infested fields the stubble should be collected and burnt or buried deeply, or in some cases the field may be submerged. The straw stacks may also be raked in such a manner as to remove a considerable proportion of the larvae before pupation. The first brood is most destructive to early rice, whereas the second attacks those varieties maturing later. Tall varieties with soft stalk tissue are most readily attacked, as also are the deeply coloured ones. Heavy infestations follow the use of manure on the growing crop, or the removal of water from the paddy field.

S. bipunctifer is not known to attack any plant other than rice in Japan, where its distribution is relatively limited, so that although it inflicts greater damage than *C. simplex*, it is a less important pest. The adults are chiefly active from 8 to 9 p.m., more than 80 per cent. of the total catch of moths in light-traps being taken before midnight. Oviposition, which begins a day or two after emergence, lasts 4–5 days, during which period an average of 4–5 egg-clusters, with a maximum of 8, are deposited. The number of eggs in each cluster averages 50, but may be as great as 100. They are usually deposited on the upper surface of the youngest leaves, near the tip, though the proportion deposited on the lower surface is greater than in the case of *C. simplex*. The newly hatched larvae are carried by the wind to other plants, sometimes at a considerable distance, and immediately penetrate the stem at the highest point, causing the heart and young leaves to die while the remainder of the plant is still green. The larva then

bores downward and the whole plant dies. After this the larva migrates to another plant and rolls itself in one of the leaves, penetrating to the base of the stalk before pupating and making a small hole through the stem wall to admit of the emergence of the adult.

S. bipunctifer differs from *C. simplex* in showing a distinct tendency to dispersion, so that it is rare to find more than one larva in a stem, and the amount of damage is correspondingly increased. In Japan proper there are usually three generations, and in Formosa four in the north and five or more in the south. Whereas the first two broods produce dead hearts, the rice plants have attained the stage at which the head is being formed by the time the third brood hatches, and the result is the formation of white ears. The degree of infestation by the third brood depends on the variety of rice attacked, the late and early varieties proving less attractive than those at an intermediate stage of maturity. The winter is passed in the mature larval stage in stubble left in the field, moist fields giving a rather higher percentage of successful hibernation than dry ones. The larva is susceptible to drought and cold, and its winter mortality is much greater than that of *C. simplex*. It is also unable to withstand extended submergence. The control measures employed are similar to those used against *C. simplex*. Methods of treating stubble against the hibernating larvae include burying it under a layer of clay at least 5 inches deep. Transplanting 7–10 days later than usual has proved successful in avoiding the numerical peak of the adults.

Aldrich (J. M.). **New Genera and Species of Muscoid Flies.**—*Proc. U.S. Nat. Mus.*, lxxvi, art. 15, no. 2812, 13 pp. Washington, D.C. [1929].

Among the species dealt with are the Tachinids, *Phorocera rusti*, sp. n., reared from the Noctuid, *Remigia punctularis*, Hb. (*repanda*, auct.) from Tucumán, Argentina, and *Cartocometes io*, sp. n., reared from the Lasiocampids, *Malacosoma disstria*, Hb., in Vermont, and *M. americana*, F., in Massachusetts.

Crumb (S. E.). **Tobacco Cutworms.**—*Tech. Bull. U.S. Dept. Agric.*, no. 88, 179 pp., 9 pls., 19 figs., 84 refs. Washington, D.C., May 1929.

The information contained in this detailed survey of the cutworms attacking tobacco in the United States, which deals with 25 species, is largely taken from the literature. The distribution of cutworms and the factors affecting it are discussed, and the coloration and anatomy of the larvae are described, with a key to those of 23 of the species dealt with, in addition to partial keys to the eggs, first instar larvae and pupae. An account is given of various methods employed in breeding cutworms, and the interrelation between their seasonal history and distribution is discussed. A section dealing with natural control includes a comparative examination of the sources of mortality in multiple-brooded and single-brooded cutworms, notes on and host-lists of the various insect parasites and disease organisms attacking them, and a brief discussion of climatic agencies. The species are then dealt with individually, all stages being described, and notes on bionomics are given in each case.

The values of numerous remedial measures habitually employed, or specifically recommended by various workers, are compared and discussed. Results obtained by the author in comparative applications in the field of a mixture of 40 lb. wheat-flour and 1 lb. Paris green, applied to the plants as a dust at the rate of 6 U.S. qts. to the acre, and a sweetened bran bait consisting of 25 lb. wheat bran, 1 lb. Paris green, 2 U.S. qts. syrup and 5 U.S. gals. water, at the rate of 10 gals. to the acre, indicate that the bran bait, when properly made up, should be more effective than a safe dosage of the dust and is less expensive. A dust that has previously proved safe may become dangerous under conditions such as moist weather followed by hot sun. The constitution of poison baits is discussed from the results obtained by various authors, bran being the generally favoured bait. Experiments with various baits consisting of 1 lb. Paris green and 96 lb. carrier, in which sawdust was either substituted for bran or mixed with it in varying proportions, and an abundance of succulent vegetation was provided in order to determine the relative attraction of the baits compared with green food, indicated that pine was less attractive than poplar or oak sawdust; but it is evident that the addition of even 25 per cent. of sawdust effects a decided reduction in the attractiveness of the bait, though the addition of 50 per cent. only decreases the attractiveness of the bait by about an equal amount.

Tests of the relative toxicity of 26 arsenical and 22 non-arsenical compounds indicated that, with the exception of sodium fluoride, all the substances possessing suitable qualities were arsenicals. The relation of dosage to infestation is discussed, and it is suggested that when the cutworms are very numerous, so that they take any available food, a concentrated dosage (2 lb. arsenical to 50 lb. bran) applied in a moderate quantity of bait is more economical than a liberal application at a lighter dosage. Field observations indicate that any of the seven most satisfactory arsenicals will give excellent results in all but very extraordinary infestations at a dosage of 1 lb. to 50 lb. bran, applied at the rate of 10–20 lb. (dry weight) to the acre. Laboratory experiments to determine the relative efficiency of 1 : 24 and 1 : 48 dosages of Paris green and bran indicated that the weaker dosage was about equal in attraction to green food, and much more attractive than the stronger. Field experiments and additional laboratory tests confirm the results of these experiments in showing that the 1 : 48 dosage is more effective for the first two days and equal to the stronger dosage in the final result.

An apparatus employed to determine the attractiveness to cutworms of substances used as bait flavourings and the results secured are described. Ethyl acetate and nitrobenzene were distinctly attractive, maize syrup was markedly attractive only when fermented, and lemon juice, lemon peel, oil of orange peel and citral were repellent. An extensive series of experiments with various dosages of both Paris green and syrup to determine the relative effectiveness of sweetened and unsweetened baits did not give evidence of the slightest increase in mortality in favour of the sweetened baits, and less extensive tests with seven other arsenicals gave similar evidence, except that the results secured with potassium arsenate and potassium arsenite have been consistently in favour of the sweetened bait. The unsweetened bait was uniformly as effective as the sweetened one in field experiments that included eight species of cutworms. The proportions used were 48 lb. wheat bran, 1 lb. Paris green and 9 U.S. gals. water, and

3 U.S. qts. syrup were added to form the sweetened bait. The methods of preparing and applying baits are discussed.

Other control measures dealt with include autumn ploughing for the control of the overwintering larvae, ditch barriers, which are employed when the cutworms occur in large numbers, and the use of light-traps, which has not proved practicable. An account is given of the author's experiments with baited traps for capturing cutworm moths, the most attractive baits being fermented fruits. He did not, however, obtain any marked success with traps.

Entomology. —*47th Ann. Rep. Ohio Agric. Expt. Sta. 1927–28,* Bull. 431, pp. 69–79, 1 diagr. Wooster, Ohio, March 1929.

In addition to *Pyrausta nubilalis,* Hb., pests of maize recorded from Ohio during 1928 by C. R. Neiswander include: *Sphenophorus* (*Calendra*) *zeae,* Walsh, *S.* (*C.*) *parvulus,* Gyll., and *S.* (*C.*) *minimus,* Hart, the injury caused by these weevils being associated with that of *Oligia fractilinea,* Grote. *S. zeae* was the most numerous and injurious. Characteristic injury was observed on 40–90 per cent. of the plants, the damage occurring in every case in fields that had been under timothy for the two preceding years. Although the infestation was severe early in the year, little damage occurred after the first few days in June, in spite of the fact that live weevils could still be found in July.

Cutright and Houser record tests of various insecticides for the control of *Cydia* (*Carpocapsa*) *pomonella,* L., and curculio [*Conotrachelus nenuphar,* Hbst.]. The results of spraying during the last three years against these pests on apple indicate that summer oils alone, even with 4 or 5 applications, are almost ineffective, but when used in combination with lead arsenate give better control than ordinary sprays. Houser states that *Paratetranychus pilosus,* C. & F., became suddenly numerous after 5th August, and this high rate of development, maintained until 18th September, resulted in a heavy infestation on apple and plum, and some damage to peach in one district. Although orchards treated with dormant applications of oil were protected, trees sprayed with oil in the spring seemed particularly susceptible to injury, probably owing to destruction by the oil residues of the natural enemies of the mites. Infestation was much less pronounced in orchards that received two or more applications of dilute lime-sulphur spray during the summer than on trees similarly situated but receiving the summer programme of dusts.

Other pests of apple, recorded by Cutright, include *Anuraphis roseus,* Baker, *Aphis pomi,* DeG., *Rhopalosiphum prunifoliae,* Fitch, and several species of leafhoppers, particularly *Typhlocyba xanthippe,* McAtee. Against the latter a 99·5 per cent. mortality of the nymphs was secured with nicotine sulphate applied in the calyx spray at the rate of 1 pt. to 150 gals. Fillinger records injury to cucumber, flowers and ornamental plants under glass by *Tetranychus telarius,* L., a high percentage of the mites being killed by Volck oil emulsion. Insects recorded by Gui include *Pnyxia scabiei,* Hopk., on potato [*R.A.E.*, A, xvii, 451], *Pegomyia hyoscyami,* Panz., on beet, *Phorbia* (*Hylemyia*) *brassicae,* Bch., which was more than usually numerous on crucifers, and *Hylemyia antiqua,* Meig., which was exceptionally destructive to onions.

Brief notes are given by Stearns and Neiswander on the biology and control of *Cydia* (*Laspeyresia*) *molesta*, Busck, which is generally distributed throughout the peach-growing areas of Ohio, the infestation in 1928 showing an increase of about one-third over that in 1927. From 80 to 90 per cent. of the crop in two districts was rendered unsuitable for shipping. Infestation of apples was increasingly common, one variety showing 15–28 per cent. as compared with 2–10 per cent. from *C. pomonella*. Life-history studies indicated that the larvae require an average of 6 days longer for development in quince, 3 days in pear and 2 days in apple and plum than in peach. The length of the feeding period varied inversely with the temperature. Of the 7 species of larval and pupal parasites hitherto recorded from 16 counties in the State, *Macrocentrus ancylivora*, Rohw., and *Glypta rufiscutellaris*, Cress., are the most important. Continuous weekly records in one orchard indicate an average parasitism of 17 per cent. in 1928 as compared with 19 per cent. in 1927.

Significant results were secured against *C. molesta* in laboratory tests and orchard spraying experiments with hydrated lime alone and in combination with other materials [*R.A.E.*, A, xvii, 388, 723]. As long as the trees were heavily coated with the lime, infestation was abnormally light, but gradually increased when the treatments were discontinued and the coating began to wear away.

Suggestions for reducing infestation by *C. molesta* include autumn application of paradichlorobenzene as made against the peach tree borer [*Aegeria exitiosa*, Say] ; thorough cultivation as early as possible in spring, disking the soil of the orchard both ways to a depth of 4 inches ; careful attention to packing house sanitation and disposal of worthless fruit ; separation of early and late varieties of peaches in making new plantings ; discontinuing the interplanting of peaches and apples ; and moderation in pruning and fertilisation to avoid excessive stimulation of growth.

HUBER (L. L.), NEISWANDER (C. R.), SALTER (R. M.) & others. **The European Corn Borer and its Environment.**—*Bull. Ohio Agric. Expt. Sta.*, no. 429, 196 pp., 20 figs., 31 refs. Wooster, Ohio, December 1928.

With a view to determining how maize can be grown profitably where the European corn borer [*Pyrausta nubilalis*, Hb.] is present, a study has been made in Ohio of the insect and its behaviour, with particular reference to the factors that influence its abundance. The phases dealt with include a quantitative study of the borer and its abundance in relation to habitat ; a description of the behaviour of each stage of the insect ; an analysis of the environment with special reference to the treatment of stubble, cut fodder and standing stalks and the use of insecticides ; a discussion of environmental factors and food-plants ; and ecological interpretations. Parasites and predators have as yet been of negligible importance in reducing the numbers of the borer. Regular and thorough cleaning up of the fields has proved of some value in reducing the abundance of borers in the next crop. The factors influencing the degree of infestation include climate and weather, vegetation types and soil types, soil fertility, cultural practices such as date of planting, variety, kind of rotation, time of ploughing and application of fertilisers ; more significant still is the fact that it can be correlated with the quantity and quality of maize at the period

of flight of the moths. All these factors limit the lines of special investigations and indicate which of them are likely to be of the greatest importance. There is not yet sufficient evidence to warrant any prediction as to the exact future significance of *P. nubilalis* in Ohio; it is thought that maize will still be grown as the major crop in the State, though late planting may be necessary in the areas most favourable to the borer. It is desirable to develop new varieties or strains that will be more resistant or will escape attack to a greater degree than the best commercial varieties now in cultivation.

Wille (J.). **Die Blattschneiderameisen Südbrasiliens und Versuche zu ihrer Bekämpfung.** [The Leaf-cutting Ants of South Brazil and Experiments in combating them.]—*Tropenpflanzer*, xxxii, no. 10, pp. 404–426, 14 refs. Berlin, October 1929.

The author considers the control of leaf-cutting ants of the genus *Atta* to be the most important economic problem in South America. In southern Brazil, *A. sexdens*, L., is very common in the northern part of Rio Grande do Sul, where these observations were made; *A. nigra*, Sm., is the commonest and most injurious species throughout Rio Grande; and *A. striata*, Rog., is also very common, but not so harmful. The nests of *A. sexdens* may be as deep as 10 ft. in the ground; those of *A. nigra*, 5 ft.; and those of *A. striata*, 2 ft.

Channels filled with water or metal collars placed round the trunks are used to protect trees. Opening the nest and pouring in boiling water or kerosene emulsion sometimes proves successful against *A. striata*. Where the nest is so deep as to render digging difficult, sodium or potassium cyanide may be strewn at the entrance, when it kills the adult ants that pass through it, thus weakening the colony, but not destroying it. Carbon bisulphide may be poured in or the fumes of burning sulphur may be pumped into the nest, but neither is effective at any distance. Better results are achieved by pumping in the fumes of white arsenic (As_2O_3), the effect of which may extend to 12 ft. or more, dead larvae, pupae and adults having been found at a distance of 18 ft. The fungus plantations are also affected, so that arsenic fumes are the best known insecticide against leaf-cutting ants, though of various fumigants tested by the author, a proprietary preparation, of which the gases are a mixture of hydrogen sulphide and carbon monoxide, seems very promising and has good penetrative power.

The value of biological methods, such as the infection of the fungus plantations in the nests or the introduction of a fungus, *Penicillium brevicaule*, which gives off arsenic hydride (AsH_3) is doubtful. The view that another ant, *Prenolepis fulva*, Mayr, eradicates *Atta* has been shown to be false.

Papers noticed by Title only.

Mercet (R. G.). **Afelínidos paleárticos (Hym. Chalc.). 3a. nota.**—*Eos*, v, no. 3, pp. 215–222, 3 figs. Madrid, 30th November 1929.

Hase (A.). **Beobachtungen über Verbreitung und Verhalten des Maiszünslers** (*Pyrausta nubilalis* **Hbn. Lepidopt.**). [Observations on the Distribution and Behaviour of *P. nubilalis* in Spain.]—*Arb. biol. Reichsanst.*, xvii, no. 4, pp. 301–319, 3 figs., 1 map, 20 refs. Berlin, 1929. [*Cf. R.A.E.*, A, xvii, 217.]

Ellinger (T.) & Sachtleben (H.). **Zur Kenntnis der Parasiten von *Pyrausta nubilalis*, Hb., aus dem Rhein- und Donaugebiet.** [The Parasites of *P. nubilalis* from the Rhine and Danube Region.]—*Arb. biol. Reichsanst.*, xvii, no. 4, pp. 321–342, 4 figs., 2 pls., 64 refs. Berlin, 1929. [See *R.A.E.*, A, xvii, 215.]

Heinrich (G.). **Die Wirte einiger Ichneumoniden.** [Ichneumonids reared from Lepidoptera in Poland.]—*Konowia*, viii, no. 3, pp. 319–321. Vienna, 25th September 1929.

Prüffer (J.). **Z obserwacji i doświadczeń nad objawami plciowemi u Brudnicy nieparki** (*Lymantria dispar* **L.**). [Observations and Experiments on the Sex Manifestations of *Porthetria dispar*, L.]—*Rozpr. Wydz. mat.-przyr. Akad. Um.*, xxiii-xxiv (1923–24), A–B, pp. 97–106. Krakow, 1927.

[Berezhkov (R. P.).] **Бережков (Р. П.). Brief Instructions for collecting Acrididae.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 2 (5), pp. 94–97, 2 refs., 1 fig. Tomsk, July 1927.

Froggatt (W. W.). **Notes on Gall-making Coccids** [in Australia], **with Descriptions of new Species.**—*Proc. Linn. Soc. N.S.W.*, liv, pt. 4, pp. 375–378, 2 pls. Sydney, 25th October 1929.

Greenwood (W.). **The Food Plants or Hosts of some Fijian Insects. III.**—*Proc. Linn. Soc. N.S.W.*, liv, pt. 4, pp. 344–352. Sydney, 25th October 1929. [*Cf. R.A.E.*, A, x, 177 ; xii, 467.]

Miyoshi (K.). **A brief History of Entomology in Japan. I-VII.** [*In Japanese.*]—*J. Plant Prot.*, xv, pp. 542–549, 604–609, 665–671 ; xvi, pp. 93–97, 153–158, 212–217, 289–293. Tokyo, 1928–29.

Maulik (S.). **Chrysomelidae** [*sens. lat.*, including a Description of the Larva of *Promecotheca reichei*, Baly].—*Insects of Samoa*, pt. iv, fasc. 3, pp. 177–215, 18 figs. London, Br. Mus. (Nat. Hist.), 23rd February 1929. Price, 2*s.* 6*d.*

Beeson (C. F. C.). **Platypodidae and Scolytidae.**—*Insects of Samoa*, pt. iv, fasc. 4, pp. 217–248, 13 figs. London, Br. Mus. (Nat. Hist.), 22nd June 1929. Price, 2*s.* 6*d.*

Taylor (T. H. C.). **Investigations in Trinidad on a Parasite** [*Liothrips urichi*, Karny] **for** *Clidemia hirta.*—*Agric. J. Dept. Agric. Fiji*, i, no. 2, pp. 2–8. Suva, 1928. [See *R.A.E.*, A, xvi, 602.]

Marshall (W. S.). **The hypodermal Glands of the Black Scale,** *Saissetia oleae* **(Bernard). I. The dorsal Glands.**—*Trans. Wisconsin Acad. Sci.*, xxiv, pp. 427–443, 3 pls., 17 refs. Madison, Wis., November 1929.

Crosby (C. R.). **An unexpected Food Plant** [*Cypripedium acaule*] **of the Striped Cucumber Beetle** [*Diabrotica vittata*, F.] **(Coleop.: Chrysomelidae).**—*Ent. News*, xl, no. 10, p. 328. Philadelphia, Pa., December 1929.

Mansuy (M. C.). **Collection and Preservation of Insects for Use in the Study of Agriculture.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1601, 19 pp., 18 figs. Washington, D.C., August 1929.

Gray (G. P.) & Kirkpatrick (A. F.). **Resistant Scale Investigations.** —*California Citrograph*, xiv, nos. 8–9, pp. 308, 336, 364, 380–381, 4 figs. Los Angeles, Cal., 1929.

An intensive study has been carried on during the past three years on the problem of resistance of certain Coccids attacking *Citrus* to fumigation with hydrocyanic acid gas [*R.A.E.*, A, xvi, 118]. The work is not yet considered complete, but it has been proved that there is definite resistance shown by both black scale [*Saissetia oleae*, Bern.] and red scale [*Chrysomphalus aurantii*, Mask.], and that certain modifications in the methods of fumigation can increase the percentage of mortality in both these species. Black scales from some districts were more resistant than from others; those that showed resistance were not, however, immune, but could be killed by a heavier dose of hydrocyanic acid gas that closely approached the maximum the trees could stand. Early fumigation is undoubtedly an advantage, though many very small scales survive. A series of single and double fumigations variously timed through the season indicated that black scales are more difficult to kill during the second moulting period (which seems to be a natural period of dormancy) and that such as survive are particularly hardy and sometimes able to survive subsequent treatments. Black and red scales that have been stupefied by a weak dosage of the gas are more difficult to kill than normal ones. The authors' theory is that scales so stupefied do not take in as much of the gas as they would have done in their normal condition; this phenomenon is called "protective stupefaction." This form of protection is observed when certain conditions retard distribution of gas or on account of gas leaking through the canvas of the tent and drifting to adjacent trees. Concentration of the gas during the first few minutes of exposure is therefore of the utmost importance. Several experiments in fumigation are described; these all indicate that a quick distribution, as nearly instantaneous as possible, of a high concentration of gas to all parts of the enclosed tree is the ideal method. This can be accomplished by means of a light-weight blower run by a petrol engine or, more simply, use can be made of the pressure developed when liquid hydrocyanic acid is vaporised in one of the regular machines used for the purpose. This pressure amounts to several pounds to a square inch, and by restricting the outlets and directing the gas through properly placed nozzles, excellent diffusion is obtained in less than 30 seconds. The improvement resulting from this method will be much more marked in winter and spring than in summer. During summer nights the soil is usually warmer than the air and the convection currents assist greatly in diffusion, but by increasing (even doubling) the dosage and decreasing the exposure correspondingly to avoid tree injury still better results are obtained. In the wet winter and spring months the soil is usually colder than the air both by day and night, so that there is no help from convection currents; under these conditions distribution of the gas is poor and the concentration is sometimes only strong enough to kill the scales on the lower parts of the trees. The use of the vaporiser and multiple nozzle is then particularly necessary. Scales are sometimes stupefied by gas leaking from the tents and drifting to adjacent trees; if, however, the operator is careful to work the tents against the air movement, the leaking gas will only be carried to the trees already fumigated.

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St. George (R. A.). **Protection of Log Cabins, Rustic Work, and Unseasoned Wood from Injurious Insects.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1582, 19 pp., 23 figs., 8 refs. Washington, D.C., July 1929.

A somewhat popular account is given of the bionomics and control of beetles infesting log cabins and rustic woodwork in the eastern and southern parts of the United States. To prevent damage by beetles that prefer freshly cut wood, logs and poles for use in rustic structures should be cut in October or November and piled at once either off the ground or under cover in such a way as to dry the inner bark rapidly and thoroughly before the beetles begin to fly in the spring. In the case of wood used in the construction of rustic furniture, mallets, etc., cutting should be restricted to the late autumn and winter months and the wood either utilised before the flight of the beetles or stored where it will be protected from attack. Screen cloth with 18 meshes to the inch may be employed. If cutting must be done during the spring and summer months, the poles should be removed from the forest as soon as they are cut and utilised at once, as a few days' exposure in the forest at this time is sufficient for infestation, which may develop after the manufacture of the finished product. Waste material on which the bark remains should not be left lying in factory yards, since it may serve as a breeding-place for the beetles. Certain species are not always readily controlled by these measures, and to obtain the maximum protection the wood should be treated in spring with pyridine or a high grade coal-tar creosote, diluted with three parts of kerosene, a process that may also be applied to poles freshly cut in spring that cannot immediately be moved from the forest. Where a slight staining is objectionable, the bark may be removed in sections, the liquids applied to the sapwood, and the bark subsequently replaced, using large headed nails, one to each square foot being usually sufficient. Where bark is not especially required, the poles may be peeled and treated as described above, the advantage of this method being that the poles may be cut at any time of the year without danger of their being attacked, and the creosote helps to preserve the wood. Untreated peeled poles may be used provided that they are partly seasoned. For treating wood after infestation, crude orthodichlorobenzene at full strength or one part of paradichlorobenzene dissolved in three parts by weight of kerosene is recommended. Both chemicals may, however, destroy the finish on furniture and necessitate re-varnishing.

Gilliatt (F. C.). **A Key to certain Tortricid Larvae occurring in Nova Scotia with Notes on their Habits and Life-histories.**—*Sci. Agric.*, x, no. 2, pp. 120–127, 3 pls. Ottawa, October 1929.

In many fruit-growing districts in the Annapolis Valley the larvae of certain Tortricid moths are important orchard pests [*R.A.E.*, A, xvii, 91]. As many of these species closely resemble each other, a simple key is given to the mature larvae that will permit of their ready identification. The early larval stages are so similar that it was found impossible to classify them readily by distinguishable characters. The life-histories are briefly dealt with.

Plantesygdomme i Danmark 1928. Plant Diseases and Pests in Denmark 1928.—*Tidsskr. Planteavl*, xxxv, pp. 421–475. Copenhagen, 1929. (With a Summary in English.)

Pests occurring in Denmark during 1928 include: *Tipula paludosa*, Mg., which was numerous on grain seedlings and swedes, but was controlled by poison bait; *Oscinella* (*Oscinis*) *frit*, L., which caused damage to wheat; *Ceuthorrhynchus quadridens*, Panz., which occurred frequently on cabbage, cauliflower and turnip; and *Contarinia nasturtii*, Kieff., which was probably responsible for malformations of flowers in swedes. Of a number of winter washes tested, tar distillates and oil sprays proved efficient against the eggs of *Cheimatobia* [*brumata*, L.] and *Psylla mali*, Schmidb., and certain oil emulsions were satisfactory against *Paratetranychus pilosus*, C. & F.

RICCHELLO (A.). **Descrizione e notizie della** *Mayetiola avenae* **March. (Diptera, Cecidomyidae) in Italia.**—*Boll. Lab. Zool. Portici*, xxiii, pp. 28–97, 25 figs. Portici, 25th September 1929.

In 1929, *Mayetiola avenae*, March., caused considerable damage to oats in the province of Foggia, Italy. All stages are described, the characters differentiating this Cecidomyiid from the closely similar *M. destructor*, Say, receiving special attention. There are two generations a year, the adults appearing in autumn and spring. The actual pupal stage lasts about a month, but is preceded by a period in which the larva remains dormant in the puparium; this period lasts about 6 months in summer and somewhat less in winter. Lack of moisture delays the emergence of the adult, and if the soil is excessively dry, either generation may fail to appear. Oviposition occurs within a few hours of emergence, the eggs being usually laid on the leaves of the food-plant. Unfertilised eggs do not hatch. In the laboratory, at a temperature of 8–9° C. [46·4–48·2° F.], the eggs hatched in about 15 days, 20–21 days being the longest period. The larva moves down the leaf to the joint of the stem, which it enters to suck the juices of the stalk. Newly hatched larvae can live under water for as long as 10–12 days, so that a flood does not check infestation. As in autumn the eggs are deposited on quite small plants, it is always the joint at the base of the plant at soil level that is infested by the resulting larvae, whereas those of the spring generation usually attack the third or fourth joints.

The injury done by *M. avenae* resembles that by *M. destructor* and the measures to be adopted are identical, including crop rotation, the destruction of self-sown plants, the destruction of straw after threshing, and burning the stubble.

BALLS (W. L.), TEMPLETON (J.), BROWN (C. H.) & KILANI (M.). **The natural Crossing of Cotton Flowers in Egypt.**—*Bull. Minist. Agric. Egypt*, no. 89, 27 pp. Cairo, 1929.

As a result of field investigations in Egypt, it has been observed that certain species of Hymenoptera are much more important agents in the natural crossing of cotton flowers and consequent varietal deterioration than the honey-bee. Among these the most common are *Nomia rufiventris*, Spin., and, secondly, *Anthophora albigena*, Lep., and *Halictus scabiosae*, Rossi. These three, together with other

species of *Nomia* and *Halictus*, were active during the same early period as the honey-bees, and then decreased in numbers, until hardly any were seen in late August and September. *Xylocopa aestuans*, L., and *Campsomeris* (*Dielis*) *collaris*, F., were active after June, and some individuals were observed in the field as late as 10th September.

Studies described show that a propagation plot should be something over 200 metres across, so as to give a hundred-metre belt all round a small central portion. Only seed from this portion can be regarded as likely to contain less than one vicinistic rogue per thousand.

Müller (K. M.). **Der Getreidelaufkäfer und seine Bekämpfung.** [*Zabrus tenebrioides*, Goeze, and its Control.]—*Landw. Wschr. Sachsen*, lxxxv, no. 50, pp. 965–966, 1 pl. **Die Runkelfliege** (*Pegomyia hyoscyami* **Panz.**) **und ihre Bekämpfung.** [The Beet-fly, *P. hyoscyami*, and its Control.]—*Op. cit.*, lxxxvi, no. 17, pp. 319–320, 1 pl. **Die Lebensweise der Gamma-Eule.** [The Biology of *Phytometra* (*Plusia*) *gamma*, L.]—*T.c.*, no. 31, pp. 573–575. **Die Rübenblattwanze, ihre Lebensweise und Bekämpfung.** [The Beet-leaf Bug, *Piesma quadrata*, Fieb., its Biology and Control.]—*Op. cit.*, lxxxvii, no. 7, reprint 2 pp. **Bedrohliches Auftreten von Rübenaaskäfern in der Provinz Sachsen.** [A threatening Occurrence of Beet Silphid Beetles in the Province of Saxony, Prussia.]—*T.c.*, no. 23, p. 438, 2 figs. **Rübenblattfrass durch den nebligen Schildkäfer** (*Cassida nebulosa* **L.**). [Injury to Beet Leaves by *C. nebulosa*.]—*T.c.*, no. 32, p. 618, 1 fig. Halle a. Saale, 1927–29.

These are popular articles on beet pests occuring in Germany.

Molz (E.) & Müller (K. M.). **Der Luzerneblattnager** *Phytonomus variabilis* **Hbst., ein neuer gefürchteter Schädling in der Provinz Sachsen.** [The Lucerne Leaf Weevil, *Hypera variabilis*, a new and dangerous Pest in the Province of Saxony, Prussia.]—*Landw. Wschr. Sachsen*, lxxxvii, no. 29, pp. 557–558, 5 figs. Halle a. Saale, 1929.

Notes are given on the bionomics and control of *Hypera* (*Phytonomus*) *variabilis*, Hbst., which is an important pest of lucerne and has been recorded for the first time in various parts of the province of Saxony, Prussia.

Götze (G.). **Hafer und Fritfliege.** [Oats and the Frit Fly.]—*Pflanzenbau*, v, p. 346, 1929. (Abstract in *Fortschr. Landw.*, iv, no. 21, p. 701. Vienna, 1st November 1929.)

From three years' work with 74 varieties in Germany, it is concluded that physiological variations in oats determine the degree of infestation by the frit fly [*Oscinella frit*, L.], some varieties exhibiting a considerable degree of resistance.

Malenotti (E.). **Sui danni del Cefo ai frumenti Ardito e Mentana.** [The Injury done by *Cephus pygmaeus* to the Ardito and Mentana Varieties of Wheat.]—*Giorn. agric. Domenica*, 1929, no. 33, reprint 13 pp., 3 figs. Piacenza, 18th August 1929.

This paper describes the injury done to these varieties of wheat in Italy by *Cephus pygmaeus*, L., which resulted in a loss in weight of the crop of 33·1 per cent. for Ardito and 27·9 for Mentana.

MALENOTTI (E.). **Schiarimenti sull'impiego dell'esca al fosfuro di zinco contro le Grillotalpe** (*Curtilla gryllotalpa* **L.**). [Directions for using the Zinc Phosphide Bait against the Mole-cricket, *Gryllotalpa gryllotalpa*.]—*Il Coltivatore*, no. 29, 1929, reprint 8 pp., 1 fig. Casale Monferrato, October 1929.

Excellent results were obtained by the author against *Gryllotalpa* (*Curtilla*) *gryllotalpa*, L., by means of a poison bait prepared by moistening 20 lb. broken rice with ½ gal. water (the rice must not be steeped in the water) and then dusting it with 1 lb. zinc phosphide. The bait should be thoroughly mixed until it is of a uniform iron-grey colour. It is strewn on the ground, while still moist, at sunset. Heavy rain washes the phosphide, which is insoluble in water, from the rice grains. The bait is poisonous to poultry and domestic animals.

TEODORO (G.). **Osservazioni sui Lecanii parassiti del Gelso.** [Observations on the Lecaniine Coccids infesting Mulberry.]—*Indust. bacol.*, iii, no. 10, pp. 5–7, 3 figs., 4 refs. Milan, October 1929.

The larvae of the Lecaniine Coccids infesting mulberry in Italy undergo a diapause in autumn and winter, when their growth is almost arrested. The newly hatched larvae do not remain for long under the mother scale, and even the latest individuals have attached themselves to the leaves before autumn. There is no overlapping of the generations as in *Coccus* (*Lecanium*) *hesperidum*, L., or still more in such Diaspines as *Aspidiotus hederae*, Vallot. Sprays are only effective when the larvae are active and migrating, either after hatching about May or in September when they leave the foliage for the branches.

BOSELLI (F.). **Elenco delle specie d'insetti dannosi e loro parassiti ricordati in Italia dal 1911 al 1925.** [Catalogue of injurious Insects and their Parasites recorded in Italy from 1911 to 1925.]—Roy. 8vo, viii+265 pp. Portici, R. Ist. sup. agrar., 1928.

This catalogue is in continuation of a previous one [*R.A.E.*, A, xvi, 376], and consists of a bibliography, a list of insect and other pests, the former arranged in alphabetical order under genera, and a list of the insect predators and parasites of pests. The food-plants or hosts of each insect are recorded and there is an index to the plants.

MALENOTTI (E.). **Esperienze contro le tignole dell'uva in Maremma.** [Experiments against the Vine Moths in the Maremma District of Tuscany.]—*Pagine agric.*, September 1929, reprint 4 pp., 1 fig., 1 ref. Leghorn, 1929.

Clysia ambiguella, Hb., and *Polychrosis botrana*, Schiff., were more than usually abundant on vines in 1929, at least as regards the first generation, in the Tuscan Maremma. In experiments a proprietary calcium arsenate dust insecticide, containing 13 per cent. of tricalcic arsenate, applied three times on a vineyard of about 5 acres (on 31st May, 8th June, and at the end of June), killed about 70 per cent. of the larvae.

MALENOTTI (E.). **Il "Meritolo" contro la tignola del melo** (*Hyponomeuta malinellus*, **Zell.**). [" Meritolo " against the Apple Moth, *H. malinellus.*]—*Italia agric.*, 1929, no. 9, reprint 9 pp., 11 figs., 1 ref. Piacenza, September 1929.

Successful results were obtained with a proprietary calcium arsenate dust [see preceding paper] against *Hyponomeuta malinellus*, Zell., infesting apple in the province of Verona. Those larvae that survived ceased to feed and did not succeed in spinning cocoons, thus confirming observations on the effect of calcium arsenate dusts on other Lepidotera [*R.A.E.*, A, xvii, 494].

PAOLI (G.). **Alcune applicazioni delle soluzioni di cianuro di sodio nella lotta contro gl'insetti.** [Some Applications of Solutions of Sodium Cyanide against Insects.]—*Boll. R. Staz. Pat. veg. Roma,* ix (N.S.), reprint 11 pp., 4 figs. Florence, 1929.

Four gallons of a 3 per cent. solution of sodium cyanide, poured into nests of *Macrotermes* (*Bellicositermes*) *bellicosus*, Smeath., in Italian Somaliland, destroyed all the termites except those at the deepest part where the soil had not been wetted. Against the ant, *Tapinoma erraticum,* Latr., in Italy, solutions as weak as 3 per mille are effective, but a large amount of liquid must be used over a large area of ground.

In Italy, the Argentine ant [*Iridomyrmex humilis*, Mayr] is trapped in boxes with sides measuring about 1 ft. square and wire netting bottoms, filled with manure and straw, in which the ants make their nests. It is usual to kill them by means of carbon bisulphide, but a 3 per mille solution of sodium cyanide is easier to apply, 5 pints being poured into each box. This method was also used on manure and refuse heaps.

In experiments in fumigating in a room against *Pseudococcus mamillariae*, Bch., on *Cereus*, the sodium cyanide was simply placed on the floor. As a result of these tests, the author recommends the use of ½ oz. to 1,000 cu. ft., the fumigation being repeated after 10–15 days, though the plants seem to be able to resist a dosage of 1 oz.

KEMNER (N. A.). **Aus der Biologie der Termiten Javas.** [The Biology of the Termites of Java.]—*Cong. intern. Zool.*, x (1927), pt. 2, pp. 1097–1117, 5 figs. Budapest, 1929.

Notes are given on the types of nests made by various termites in Java.

LANGHOFFER (A.). **Das massenhafte Eingehen der Eichen in Jugoslavien von entomologischer Seite betrachtet.** [The large Numbers of Oaks destroyed in Jugoslavia considered from the entomological Standpoint.]—*Cong. intern. Zool.*, x (1927), pt. 2, pp. 1196–1203, 9 refs. Budapest, 1929.

The author considers the enormous destruction of oaks that is of periodical occurrence in Jugoslavia to be principally due to insects, which strip the trees of their first foliage, when mildew follows and destroys the second. The trees can recover from one defoliation, but two in the same year prove fatal. The suddenness and periodicity of the destruction is characteristic. In one district only 80 oaks were destroyed in 1910–11, as compared with 56,490 in 1911–12. In another

district the numbers were 22 in 1915–16 and 139,695 in 1916–17. *Porthetria* (*Lymantria*) *dispar*, L., is responsible for most of the damage, other insects concerned being *Agrilus biguttatus*, F., *Platypus cylindrus*, F., *Xyleborus monographus*, F., *Cerambyx heros*, Scop., and *Gasterocercus depressirostris*, F. The larvae of *P. dispar* appear in Jugoslavia in March or April and pupate at the beginning of June, the adults emerging 14 days later. The larvae are parasitised by Tachinids.

KADOCSA (G.). **Der Distelfalter als landwirtschaftlicher Schädling in Ungarn.** [*Pyrameis cardui* as a Pest of Agriculture in Hungary.]—*Cong. intern. Zool.*, x (1927), pt. 2, pp. 1231–1233. Budapest, 1929.

Pyrameis cardui, L., feeds chiefly on weeds, but since 1923 it has been recorded as causing considerable damage to lupins in Hungary, the larvae feeding on the leaves, which they spin together. Arsenicals may be applied when the larvae first appear in May, though whether general spraying of lupin fields is advisable depends on whether the crop is to be used as manure or fodder, or for seed.

WORONIECKA-SIEMASZKOWA (J.). **Spostrzeżenia nad szkodnikami roślin uprawnych, występujacemi w powiatach Pulawskim i Lubelskim w r. 1928.** [Observations on the Pests of cultivated Plants in the Surroundings of Pulawy and Lublin in 1928.]—*Mém. Inst. nat. polon. Econ. rur. Pulawy*, ix, pt. 2, pp. 555–573, 2 figs., 4 refs. Pulawy, 1928. (With a Summary in English.)

A list is given of 73 insect pests observed in the Lublin region (eastern Poland) in 1928, of which the more important include: *Longitarsus parvulus*, Payk., and *Aphthona euphorbiae*, Schr., on flax; *Cassida nebulosa*, L., and *C. nobilis*, L., on beet; *Baris chlorizans*, Germ., and *B. laticollis*, Mrsh., which severely infested cabbage and cauliflower; *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) on various crucifers; *Phytometra gamma*, L., and *Agrotis ipsilon*, Hufn. (*ypsilon*, Rott.), on beet, potatoes, etc.; and *Crioceris duodecimpunctata*, L., and *C. asparagi*, L., on asparagus. *Cephus pygmaeus*, L., and *Chlorops taeniopus*, Mg., were very abundant on winter and summer wheat respectively, and 40 per cent. of the millet (*Panicum miliaceum*) was destroyed by *Pyrausta nubilalis*, Hb.

Willows were attacked by *Plagiodera versicolor*, Laich., *Phyllodecta* sp., *Scoliopteryx libatrix*, L., *Haltica tamaricis*, Schr., *Melasoma saliceti*, Wse., *Lepyrus palustris*, Scop., *Cryptorrhynchus lapathi*, L., *Rhynchaenus* (*Orchestes*) *populi*, F., *R.* (*O.*) *foliorum*, Müll., *Plastenis retusa*, L., *Earias chlorana*, L., and *Phyllocnistis saligna*, Zell. Raspberries were injured by *Byturus tomentosus*, F., and red currants by *Aegeria* (*Trochilium*) *tipuliformis*, Cl. *Magdalis ruficornis*, L., attacked cherries in spring, and *Enarmonia woeberiana*, Schiff., infested them in summer, mining under the bark.

Pests of pines included *Hylobius abietis*, L., *Pissodes notatus*, F., *Strophosomus rufipes*, Steph., *Tortrix* (*Cacoecia*) *piceana*, L., *Exoteleia* (*Heringia*) *dodecella*, L., and *Eriophyes pini*, Nal., which was responsible for malformations on the branches of old trees. Oaks were attacked by *Rhynchaenus* (*Orchestes*) *quercus*, L., which was the most injurious pest, *Diphtera alpium*, Os., *Phalera bucephala*, L., and *Hylophila prasinana*, L.

[Masaïtis (A. I.).] **Масайтис (А. И.). Data on the Fauna and Biology of Elaterids in Siberia.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 1–41, 19 refs. Tomsk, January 1929.

Elaterids are widely distributed in Siberia, and come next to locusts in importance as pests, causing especially heavy damage in the western part of the country. A further account is given of studies on their bionomics in the Novo-Sibirsk and Kamen districts in 1924–27, with a list of 31 species occurring there and notes on their food-plants and distribution [*cf. R.A.E.*, A, xviii, 6]. As the larvae of *Cardiophorus* did not infest wheat under laboratory conditions, the author is doubtful whether *C. atramentarius*, Er. (?) is of economic importance.

The effect of the temperature and meteorological conditions on the date and duration of the period of flight of *Selatosomus latus*, F., *S. spretus*, Mannh., *Agriotes sputator*, L., *A. obscurus*, L., and *A. lineatus*, L., is discussed at length. *A. sputator* is usually on the wing in the evening, whereas *S. latus* and *S. spretus* are active in the daytime. Outbreaks in Siberia are much favoured by the abundance of fallow land, where the beetles concentrate during the flight period, *S. latus* preferring growths of *Artemisia glauca*, and *S. spretus* and *A. sputator* fields covered with *Agropyrum* (*Triticum*) *repens*. The adults usually emerge from the pupae about August, but remain in the soil till the following May, when the active life begins. This lasts one month in the case of *S. latus* and *S. spretus*, and two in that of *A. sputator*.

The temperature and humidity of the soil are the chief factors that regulate the vertical distribution of the larvae [*cf. loc. cit.*]; the dryness of the upper layers in the second half of the summer compels them to penetrate deeper, but the author considers that they continue to feed on the roots of the plants until the following spring. In western Siberia they infest in order of preference the stems of summer wheat, oats and winter rye, the bulk of the injury being caused in June before the tillering of young plants, and also feed on the sown grain, of which they destroy 4–5 per cent. The damage caused to watermelons, potatoes and beet is considerably less. In the laboratory not more than 10 per cent. of the larvae were killed by feeding on linseed cake poisoned with strychnine, Paris green or sodium arsenite, at the rate of 1, 4 and 3 parts by weight to 80 of the linseed cake. The larvae were not affected by eating grains of wheat dusted with Paris green or white arsenic or soaked in a saturated solution of sodium arsenite, mercury bichloride or strychnine. Larvae lived as long as a month without any food at a temperature of 18–28° C. [64·4–82·4° F.], and nearly two months at 12–20° C. [53·6–68° F.]. They also survived submergence in water for periods varying from 1 to 5 days. In view of this resistance of the larvae to poisons, etc., measures should be chiefly directed to the improvement of the condition of the plants by methods that accelerate their development and growth.

Two species of Carabids, *Pterostichus* sp. and *Ophonus* (*Pardileus*) *calceatus*, Duft., have been observed attacking the Elaterid larvae, and were very abundant at the end of July and beginning of August. The value of birds in destroying the wireworms during the harrowing of the fields is briefly discussed. In the laboratory one *Selatosomus* larva was infested with an endoparasite, belonging in all probability to the Gordiacea, while another of these worms occurred in the soil. The larvae of *Selatosomus* were frequently parasitised by a mite of the

genus *Tyroglyphus*, which in 1926 infested 7–33 per cent. in the field. A fungous disease and a bacterial infection killed a considerable number of the *Selatosomus* larvae in the insectary, but were less effective in the field. The bacterial disease appeared to be associated with the parasitism of the larvae by *Tyroglyphus*, as it was much more widespread when the mites were abundant, and larvae of *Agriotes*, which were not infested by the latter, remained immune. It is possible that the punctures caused by the mite in the skin of the larva enable the infection to penetrate into it.

The larvae of both *Selatosomus* and *Agriotes* usually begin to pupate about the middle of July at a depth of 3–6 ins., and the pupal stage lasts 3 or 4 weeks. The value of ploughing to kill the pupae depends on the depth at which they occur ; from 50 to 100 per cent. may be destroyed by this means.

[Aksenova (E. N.).] **Аксенова (Е. Н.). The Biology of the Rape Blossom Beetle** (*Meligethes aeneus* **F.**) **and its economic Importance under the Conditions of the Tomsk Region.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 42–57, 3 refs. Tomsk, January 1929.

An account is given of laboratory and field observations on *Meligethes aeneus*, F., carried out near the town of Tomsk in 1925 and 1926, and of preliminary experiments on its control in 1927. In this district the beetle has one generation a year, the life-cycle from egg to adult lasting about 33 days. The mass emergence of the overwintered adults from the soil occurs at the end of May or beginning of June ; the chief injury is done by them, as they feed on the interior of unopened blossom buds of crucifers, destroying the pistils in most of them, which results in a 50 per cent. loss of the crop of seed. Cabbage, swedes, radish, rape, *Barbarea vulgaris* and wild mustard (*Sinapis arvensis*) are the food-plants on which oviposition occurs. When the plants flower, the beetles are less injurious, as then they feed chiefly on the pollen, although some of the stamens and pistils are also destroyed. Pairing begins within 7–10 days after emergence from hibernation, oviposition chiefly occurring at the end of June and beginning of July. The eggs are laid in buds that have not been injured, singly or in batches of 5–8, and are fixed to the stamens with a sticky secretion. A female lays about 40 eggs on the average.

Under laboratory conditions 62 per cent. of the eggs hatched on the third day at a temperature of 18–19° C. [64·4–66·2° F.], and the rest on the fourth. The larvae moult twice ; as many as 10 of the first instar may develop in one bud, feeding almost exclusively on the pollen. The larvae of the second instar migrate from flower to flower and also feed on the pollen, but sometimes injure the pistils ; the injury they cause attains its peak in July, but is of much less importance than that done by the adults in June. The larvae feed for 4–11 days and then remain for 3–10 days in the soil before pupation. The latter occurs within a radius of 10–16 ins. from the chief stem of the food-plant at a depth of about 2–3 ins. Most of the pupae are found in August, and a few occur even as late as October, owing to protracted oviposition. In the insectary the pupal stage lasted 10–11 days at a temperature of about 65° F. The mass emergence of the young adults occurs in the second half of August, when crucifers are still flowering. The beetles feed on the pollen and very seldom infest the buds. They enter the soil

for hibernation in September. The economic importance of *M. aeneus* is discussed in detail. Some of the less severely infested buds produce flowers and seed.

Of the mechanical control measures tested, shaking the beetles daily from the infested plants into bowls filled with water on which was a film of oil was the most effective and considerably reduced the numbers of the beetles. Spraying and dusting with arsenicals did not injure the buds, but killed a considerable number of open flowers ; further experiments are recommended, especially in dusting with calcium arsenite. The best results were obtained with four applications of a spray of 3 lb. Paris green and 5 lb. unslaked lime to 60 gals. water, with starch paste to secure a better adherence of the spray ; this killed 90 per cent. of the beetles on swedes and 85 per cent. on cabbage. Early planting of the seedlings is recommended, in order that the plants may have flowered at the time of the mass appearance of the beetles. Cruciferous weeds should be destroyed.

[Berezhkov (R. P.).] **Бережков (Р. П.). A Note on** *Chorthippus albomarginatus* **DG.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 75–84, 17 refs. Tomsk, January 1929.

In western Siberia in 1926-28, the hoppers of *Chorthippus albomarginatus*, DeG., began to hatch about the beginning of June, and most of them reached the adult stage about the middle of July. Their development, which requires about 25 days, appears to be retarded by excessive rain and accelerated by warm dry weather. The hoppers seem to possess an elementary gregarious instinct and collect in considerable bands, the daily routine of which is more or less regular. They pass the day on or near the ground and crawl up the plants in the morning and evening. Migrations of hoppers or adults have never been observed.

In western Siberia *C. albomarginatus* inhabits all the open spaces and is met with even in the marshes, though it definitely prefers fallow lands overgrown with *Agropyrum repens*, and avoids dry southern and south-eastern slopes with a characteristic xerophilous vegetation.

Pairing and oviposition begin about a week after the adult stage is reached and are repeated many times ; under laboratory conditions a female was observed to oviposit 15 times. Soft soil free from roots of plants, such as that of cultivated land, is preferred for oviposition, the average density of egg pods being nearly 1 per sq. ft. in 1928.

In 1928 *C. albomarginatus* became so numerous as to constitute about 80 per cent. of all the injurious grasshoppers. Of cultivated crops, spring rye and spring wheat were the first to be attacked ; the green leaves were eaten and the yield was only 30 per cent. of the normal crop. In 1925 it was observed that the stalks of oats were often bitten through below the panicles, causing them to fall to the ground.

Poison baits were used for control, bran, horse-dung or sawdust being soaked in water containing 5 per cent. of sodium arsenite or Paris green. In field experiments the following amounts of poison killed over 90 per cent. of both hoppers and adults : 540 gm. sodium arsenite per hectare ; 360 gm. Paris green or 405 gm. calcium arsenite per hectare with horse-dung bait ; and 540 gm. Paris green per hectare with sawdust bait.

The author attributes the continual increase in the numbers of *C. albomarginatus* to its definite ecological association with fallow land overgrown with *Agropyrum repens* and *Artemisia*, as it is usual to allow the fields to lie fallow for several years without destroying the weeds.

[SHVETZOVA (A. N.).] **Щвецэва (А. Н.). An entomological Valuation of economic-technical Methods used in Agriculture.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 58–74, 1 ref. Tomsk, January 1929.

An account is given of observations carried out in the Omsk Government in 1927 on *Oscinella frit*, L., which is the chief pest of summer wheat and winter rye in western Siberia, and on the effect of various agricultural measures on the intensity of infestation. The drought and extreme heat that prevailed throughout the spring and the first half of the summer considerably retarded the growth of cereals and decreased their power of resistance to pests. The overwintered larvae of *O. frit* pupated 2–3 weeks earlier than usual, the mass pupation occurring about the middle of May. The mass flight of the resulting adults took place in the second half of the month, coinciding with the shooting of the summer wheat and barley, and resulted in a heavy infestation of the main haulms. The second generation, arising from adults that were on the wing in the middle of July, chiefly attacked wild grasses, especially *Setaria viridis* and *Agropyrum repens*, but the third generation seriously damaged winter rye and fodder grasses in the first half of August, the larvae remaining in the stems for hibernation. On the whole, about 50 per cent. of the plants were destroyed, as those with an injured main haulm did not tiller.

The chief factor regulating the intensity of infestation is the time of the sowing; in the case of winter rye later sowings suffered considerably less. Rye sown on 15th September was not infested; but as under the climatic conditions of western Siberia this date is too late to allow the plants to tiller before the snow falls, it is recommended that the winter rye should be sown in the second half of August. In the case of summer crops, early sowings are usually more resistant to the attacks of the frit fly than late ones; this, however, did not apply to 1927, as owing to a very hot and dry spring the flies emerged earlier than usual. Summer wheat sown in fallow land was more resistant than that sown in fields used in preceding years for root crops, and some varieties were more resistant than others. The manuring of the soil raises the power of resistance of the wheat; although more plants were damaged in a manured field, the percentage killed was less. Tests of various kinds of manures showed that differences in their composition have practically no effect on the intensity of infestation.

Other cereal pests observed were: *Phyllotreta vittula*, Redtb., which damaged the leaves of summer and winter crops; *Hylemyia coarctata*, Fall., which is recorded for the first time as a pest of winter rye in the Omsk region, and infested about 10 per cent. of the stems of plants sown in black manured fallow; *Mayetiola destructor*, Say, which attacked winter rye, especially the early sowings; *Phorbia* (*Adia*) *genitalis*, Schnabl, which damaged 3–5 per cent. of summer wheat; and Elaterid larvae, which preferred a manured soil when attacking summer wheat.

[Reinov (A. I.).] **Рейнов (А. И.). Data on the Biology of the Swedish Fly** (*Oscinella frit* **L.) under the Conditions of the Omsk Region.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 85–91, 2 refs. Tomsk, January 1929.

Summer wheat and winter rye in the Omsk Government were considerably injured by *Oscinella frit*, L., in 1926, and the character of the damage caused is described. Infestation continued till late in October, and occurred in three waves, apparently corresponding to the three generations of the fly, the first reaching its height in the middle of June at the period of the tillering of summer wheat, the second when the wheat was beginning to flower, and the third in the middle of the period of tillering of winter rye. Infestation of winter wheat was negligible. The percentage of infestation was very much higher on the outskirts of the fields where there was some natural protection from the wind. Observations and experiments indicate that the mature larvae leave the infested part of the stem and move down to below the axil of the lower leaves of the second tillering node to pupate. It is pointed out that the country is very favourable to the frit fly, as fields surrounded by small forests form natural foci of infestation, from which it may easily spread, especially in the direction of the prevailing winds.

[Vul'fson (R. I.).] **Вульфсон (Р. И.).** *Colaphellus alpinus* **Gebl. as a Pest of Market Garden Crops in Transbaikalia.** [*In Russian.*] —*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 92–96, 7 figs., 7 refs. Tomsk, January 1929.

An account is given of preliminary observations on the biology of *Colaphellus alpinus*, Gebl., near the town of Chita (Transbaikalia), where this Chrysomelid severely infested cabbage and radish seedlings in 1927. All stages are described, but the number of generations in a year has not been determined. The overwintered adults were first observed feeding on the leaves about the middle of May and became especially abundant in June. Pairing occurred from the end of May till the beginning of July, numerous eggs being laid singly or in batches of 20 or more in the soil at a depth of up to 2 ins., and sometimes on the underground parts of the stems of cabbage and radish. The young larvae fed on the epidermis of the leaves, and the mature ones on the parenchyma. In the middle of June, eggs, larvae and adults occurred simultaneously, the larvae being numerous in cabbage nurseries, where they could easily be found on the plants and crawling on the soil, etc. Newly emerged adults appeared at the beginning of July. In the laboratory the first oviposition took place within 4–9 days after the emergence of the adults ; eggs were laid by unfertilised females, but did not develop. The life-cycle of *C. alpinus* from egg to adult lasted 23–74 days.

[Mamaev (K. A.).] **Мамаев (К. А.). A preliminary List of agricultural Pests of the Kamen Region.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 134–142, 1 ref. Tomsk, January 1929.

This list of pests observed near the town of Kamen (western Siberia) during 1924–27 includes 104 insects injurious to crops and fodder grasses, forests and stored products, with brief notes on their importance, food-plants and times of occurrence. Species recorded from this district for the first time are : *Haplothrips tritici*, Kurdj., and *Chaeto-*

cnema aridula, Gyll., on cereals ; *Meligethes aeneus*, F., on flowers of crucifers ; *Epicauta dubia*, F., and *Platyscelis gages*, Fisch., on potato ; *Bothynoderes foveicollis*, Gebl., on beet ; *Tanymecus palliatus*, F., on lucerne ; *Apion apricans*, Hbst., on clover ; *Sitodrepa panicea*, L., *Anobium pertinax*, L., *A. rufipes*, F., *Ptinus fur*, L., *Dermestes laniarius*, Illig., and *Attagenus piceus*, Ol., in stored products ; *Eurydema ornatum*, L. ; *E. festivum* var. *decoratum*, H.S. ; and various forest pests, *viz.*, *Melasoma tremulae*, F., on aspen, *Hylobius abietis*, L., feeding on the bark of young pines, *Myelophilus* (*Blastophagus*) *piniperda*, L., and *Ips* (*Neotomicus*) *laricis*, F., occurring in pine stumps, *Acanthocinus aedilis*, L., *Saperda carcharias*, L., *S. populnea*, L., *Rhagium mordax*, DeG., *Otiorrhynchus tristis*, Scop., *Pissodes notatus*, F., *Hylastes ater*, Payk., *Ips sexdentatus*, Börn., *I. acuminatus*, Gyll., and *I.* (*Neotomicus*) *proximus*, Eichh.

[Shvetzova (A. N.).] **Швецова (А. Н.). Contribution to the Fauna of the Dipterous Pests of Cereals in the Environs of the Town of Omsk.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 143–146, 2 refs. Tomsk, January 1929.

The economic importance of Diptera attacking graminaceous plants in western Siberia is briefly discussed, and a list is given of the species observed near Omsk in 1925–27, with notes on their food-plants and dates of occurrence. They include *Mayetiola destructor*, Say, abundant on early sown winter wheat ; *Oscinella pratensis*, Mg., on winter rye ; *O. anthracina*, Mg., and *O. kertészi*, Beck., on *Bromus inermis* ; *O. pusilla*, Mg., which was very injurious to both summer and winter cereals and has three generations a year, of which the first and third cause the greatest injury ; *Crassiseta* (*Elachiptera*) *cornuta*, Fall., on barley ; and *Chlorops taeniopus*, Mg., *C. notata*, Mg., and *Chloropisca* (*C.*) *glabra*, Mg., on winter rye and summer wheat. The damage caused by *Meromyza saltatrix*, L., *M. nigriventris*, Mg., and *M. pratorum*, Mg., was negligible. *Phorbia* (*Adia*) *genitalis*, Schnabl, which was very common, has one generation a year, the adults emerging from overwintered pupae early in May. The larvae, which infest the young shoots of summer crops, appear about 8th June and are full-grown about the middle of the month ; they pupate in the soil close to the food-plant. Late sowings of wheat escape heavy infestation. *Hylemyia coarctata*, Fall., which caused much damage to winter rye sown in black manured fallow, has one generation a year. Hibernation occurs in the egg stage, and the larvae hatch in the second half of May ; the mass flight of the adults takes place a month later. *Phorbia* (*H.*) *cilicrura*, Rond., was injurious to turnip and other root-crops, and to winter rye in unmanured fields ; better methods of cultivation, to accelerate the growth of the shoots, would protect the plants from infestation. *Domomyza* was scarce and only caused negligible injury to the leaves of early sown summer wheat.

[Bassel' (D. G.).] **Бассель (Д. Г.). A List of Orchard Pests in the Town of Barnaul.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 147–150. Tomsk, January 1929.

In the course of studies on *Cydia pomonella*, L., carried out in Barnaul (Altai region) in 1926 and 1927, numerous other insects were observed attacking orchard trees and bush-fruits. A list of 38 species is given, with short notes on the bionomics of some of them.

[Khurtina (M. G.).] **Хуртина (М. Г.). A new Onion Pest.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), p. 151. Tomsk, January 1929.

The larvae of *Ceuthorrhynchus jacovlevi*, Schulze, which has not previously been recorded as a pest, were found on onion in the summer of 1926 in the Tomsk Government, when their number in each infested leaf varied from 1 to 20. Observations on this weevil were carried out in 1927. The overwintered adults appear at the end of April or beginning of May and feed on the parenchyma of the onion leaves, making holes through them. Pairing and oviposition begin soon after emergence ; the eggs are laid in the tissue of the leaves and hatch in 6–10 days. The larvae feed on the parenchyma from the inner side of the leaves, but do not eat through them. After 15–16 days, they make their way out through an exit hole at the base of the leaf and enter the soil for pupation, which usually occurs at a depth of 2–3 ins. and very seldom on the surface of the ground. The adult weevils emerge at the end of July or early in August and hibernate.

[Aksenova (E. N.).] **Аксенова (Е. Н.). A Note on** *Brachypterus fulvipes* **Er.** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), pp. 152–153. Tomsk, January 1929.

The Nitidulid, *Brachypterus fulvipes*, Er., was observed at the beginning of June 1927 in the Tomsk Government feeding on unopened buds and flowers of cabbage, swedes and radish, on which, however, *Meligethes aeneus*, F., was 30–100 times as numerous. The characters distinguishing the two species are indicated. In flowers infested by this Nitidulid, about 40 per cent. of the pistils were destroyed.

[Rodd (E. G.).] **Родд (Е. Г.). The Infestation of the Seeds of** *Abies sibirica* **in the Karpuisak Forest District of the Novo-Sibirsk Region by** *Megastigmus strobilobius* **Ratz. of the Family Chalcididae (Hymenoptera).** [*In Russian.*]—*Izv. sibirsk. kraev. Stantz. Zashch. Rast.*, no. 3 (6), p. 154, 1 ref. Tomsk, January 1929.

A brief note is given on the occurrence of the larvae of *Megastigmus strobilobius*, Ratz., in the seeds of *Abies sibirica* in August and September 1928 in a forest in the Novo-Sibirsk region, 1 per cent. of the seeds being infested. In the insectary an adult female emerged in January 1929.

Bodenheimer (F. S.) & Theodor (O.). **Ueber die Schädlinge der Kulturpflanzen im zentralen Sinai.** [Pests of cultivated Plants in Central Sinai.]—*Ergebnisse der Sinai-Expedition 1927*, pp. 34–37. Leipzig, 1929.

The pests observed in Sinai were *Parlatoria blanchardi*, Targ., and *Phoenicococcus marlatti*, Ckll., on date palm (*Phoenix dactylifera*) ; *Asterolecanium pustulans sambuci*, Ckll., and *Lecaniodiaspis africana*, Newst., on *Zizyphus spina-christi* ; *L. africana*, *Trioza buxtoni*, Laing, and *Homotoma ficus*, Guér., on *Ficus pseudosycomorus* ; *Lepidosaphes* (*Coccomytilus*) *zlocistii*, Bdhmr., on plum and apricot ; *Leucodiaspis* (*Leucaspis*) *riccae*, Targ., *Aspidiotus sinaiticus*, Bdhmr., and *Pollinia pollini*, Costa, on olive ; *Aspidiotus ostreaeformis*, Curt., and *Aleurodes* sp. on pear and apple ; and *Aleurodes* sp. on pomegranate (*Punica granatum*).

FERRIÈRE (C.). **On three new Chalcidoid Parasites of** *Platyedra.*—*Bull. Ent. Res.*, xx, pt. 3, pp. 255–259, 3 figs. London, October 1929.

Brachymeria fijiensis, sp. n., was bred from *Platyedra gossypiella*, Saund., in Fiji. *Eurytoma braconidis*, sp. n., appears to attack Braconid parasites of Lepidoptera, having been recorded from *Microbracon hancocki*, Wlkn. [*R.A.E.*, A, xvi, 530] in Uganda and as a hyper-parasite of *Diparopsis castanea*, Hmps., in the Anglo-Egyptian Sudan ; it has also been obtained in Tanganyika Territory. *Elasmus johnstoni*, sp. n., was bred from *P. gossypiella* in the Punjab and from *P. gossypiella*, *Earias insulana*, Boisd., and larvae in bolls of *Abutilon* sp. in the Anglo-Egyptian Sudan.

UVAROV (B. P.) & ZOLOTAREVSKY (B. N.). **Phases of Locusts and their Inter-relations.**—*Bull. Ent. Res.*, xx, pt. 3, pp. 261–265, 5 refs. London, October 1929.

The senior author's original theory of phases [*R.A.E.*, A, ix, 561] recognised the existence in swarming locusts of two extreme phases, connected by a series of transitional ones. These phases differ from each other in their morphological characters, but the main differences are biological. This has, however, been overlooked by most workers, and the purely morphological conception has led to the designation of each phase by the name under which that form of the species was first described. In order to avoid further confusion, the authors propose a scheme of standard nomenclature, which should be uniform for all species and should not be bound by the formal laws of priority.

The name *phasis solitaria* is applied to the extreme form, in cases in which only isolated individuals are present in a given locality. *Phasis transiens* designates the continuous series of transitional forms ; when the transformation is in the direction from solitary to gregarious, the name *transiens* can be replaced by *congregans*, and in the case of the opposite process, the term *dissocians* can be used. Finally, the extreme form, to which belong individuals forming large and dense migrating swarms, is called *phasis gregaria*.

The following geographical subspecies of *Locusta migratoria*, L., are recognised by the authors : *Locusta migratoria rossica*, subsp. n., of central Russia ; the typical *Locusta migratoria*, L., of south-eastern Russia ; and *Locusta migratoria migratorioides*, R. & F., occurring in the subtropics and tropics. *L. migratoria rossica* is not described, as its characters were given by Predtechenskiĭ, who called it subsp. *danica* [xvii, 140], though it appears to be distinct from the true *danica*, L.

Recent studies of the junior author in Madagascar have shown that the form of *L. migratoria* occurring there (*migratorioides*) is very similar in its solitary phase to the respective phase of *L. migratoria migratoria* and *L. migratoria rossica*, but that its gregarious phase develops still further than in *L. migratoria migratoria*, so that a phase morphologically analogous to the gregarious phase of the latter represents only a transitional phase of the Madagascar locust.

A diagram representing the interrelation of the phases of the three subspecies of *L. migratoria* is given. It is shown that it is useless to identify the phases of the locusts on the basis of morphological and colour characters alone, for these can be established only after each

subspecies has been studied in detail throughout the full cycle of transformation and will be applicable only to the particular locality in which the study has been made.

The known phases of other locusts that have been recorded as distinct species are *Schistocerca gregaria*, Forsk., ph. *solitaria* (*flaviventris*, Burm.), *Nomadacris septemfasciata*, Serv., ph. *solitaria* (*coangustata*, Luc.), *Dociostaurus maroccanus*, Thnbg., ph. *transiens* (*degeneratus*, Baranov), and *Melanoplus mexicanus atlantis*, Riley, ph. *gregaria* (*spretus*, Walsh).

Evans (J. W.). **New Species of** *Nysius* (**Hem., Lygaeid.**) **from South Africa.**—*Bull. Ent. Res.*, xx, pt. 3, pp. 267–270, 1 fig., 11 refs. London, October 1929.

In the few published accounts of insects of the genus *Nysius* attacking crops in South Africa, the specific name of the Lygaeid concerned has always been given as *Nysius binotatus*, Germ. Re-descriptions are given of *N. binotatus*, originally described from the Cape of Good Hope and of which *N. pallens*, Dall., is considered a synonym, and *N. albidus*, Dall., originally described from Sierra Leone. Three new species are also described, *Nysius ståli* and *N. natalensis* from Natal, and *N. pallidus* from Cape Province. Further notes are given on the genera included under *Nysius*, auctt. [*R.A.E.*, A, xvii, 349].

Brain (C. K.). **Insect Pests and their Control in South Africa.**—Demy 8vo, xii+468+viii pp., 204 figs. Cape Town, Die Nasionale Pers Beperk, 1929. Price, 25*s*.

This comprehensive handbook forms a useful work of reference on the insect pests of South Africa and the means for their control, and it is hoped that it may prove a basis for future study on a subject of vital importance to the development of the country. The total damage done by insects in South Africa each year amounts to many millions of pounds. Besides the injury to man and animals and to cultivated crops, the feeding value of the veldt is reduced annually by perhaps 20 per cent., and forest trees and timber are also seriously damaged. The information given in this book should enable the farmer to cope with the insect problems he encounters, and a few references are appended to each chapter indicating where additional information may be found. Many of the illustrations are from original drawings or photographs by the author.

Johnston (H. B.). **Pink Bollworm** (*Platyedra gossypiella*, **Saunders**) **in the Gezira District of the Sudan in 1927 and 1928.**—*Bull. Ent. Sect. Sudan Govt.*, no. 26, 27 pp., 2 maps. Khartoum, February 1929.

Prior to 1927, infestation of cotton in the Gezira district of the Sudan by *Platyedra gossypiella*, Saund. (pink bollworm) had never been considered very serious, but in that year it averaged 3·8 per cent., and rose to 24·1 per cent. in 1928. As previous experience had indicated that the chief source of infestation of the new crop was from larvae remaining in small lots of stored, untreated seed, as much as possible of such seed was obtained as a result of legislation, propaganda and house to house search, and a large proportion of it was destroyed.

Various seeds from different sources were examined for larvae, a large percentage of which was found in inferior native-grown rain cotton. No living larvae were found in seed treated by exposing it to the sun for at least two hours at a temperature of 62° C. [143·6° F.]. Observations indicate that most of the larvae remaining after the destruction of the crop are short-cycle larvae, producing a generation of moths incapable of damaging the next crop in the absence of alternative food-plants (which have not been found). Long-cycle larvae do occur, however, in the stored seed and may apparently remain alive for as long as two years. The very low infestation of green bolls at the beginning of the season may be the result of the scarcity of long-cycle larvae from the previous crop. A noticeable point brought out in this work was the large predominance of larvae resting in single seeds. It was also found that larvae in seed lying in the open after the removal of the crop are killed, probably by the high temperature. Further work is being undertaken to determine the ratio of short-cycle to long-cycle larvae, the means of survival and the factors governing the rate of increase in the cotton crop.

Cherian (M. C.). **Life-history Notes on *Lamprosema indicata* (Pyralidae), a Caterpillar Pest of Chrysanthemums.**—*J. Bombay Nat. Hist. Soc.*, xxxiii, no. 4, pp. 857–860. Bombay, 15th October 1929.

Lamprosema indicata, F., all stages of which are described, is recorded as a pest of chrysanthemums grown commercially in a village in Madras. The eggs are laid on the lower surface of the leaves, the average number deposited by a female being 330. The larvae usually attack the leaves, but sometimes also destroy the flowers ; in certain years the plants are completely defoliated. The larval period lasts about ten days, and the total life-cycle three or four weeks, pupation occurring in a cocoon between leaves spun together, etc. The adults under observation lived 11–23 days. Spraying with lead arsenate (½ oz. to 1 gal. water) gave better results than dusting with Paris green and lime (1 : 5), though both were effective. Lead arsenate has the additional advantage of not scorching the foliage, as Paris green sometimes does. The larvae were found to be parasitised by *Elasmus indicus*, Rohw., but not sufficiently to check an infestation. Records of oviposition, life-history and longevity of adults are shown in tables.

Corbett (G. H.). **Division of Entomology. Annual Report for 1928.**—*Malayan Agric. J.*, xvii, no. 8, pp. 261–276. Kuala Lumpur, August 1929.

Notes are given on a large number of injurious insects occurring in Malaya in 1928. Amongst those of special interest are the following on coconuts : *Derelemorphus eburneus*, Mshl., the Tenebrionid, *Platydema nuciferae*, Blair, *Carpophilus humeralis*, F. (*foveicollis*, Murr.), *C. dimidiatus*, F., *Pyroderces ptilodelta*, Meyr., *Erechthias flavistriata*, Wlsm., *Opogona dimidiatella*, Zell., and *Stathmopoda adulatrix*, Meyr., all infesting the inflorescence, *Mahasena corbetti*, Tams, *Amathusia phidippus*, L., and *Setora nitens*, Wlk., which last also injured African oil palm (*Elaeis guineënsis*). Pests of leguminous green manure plants and cover crops included *Lamprosema diemenalis*, Guen., the Lycaenid, *Zizera otis*, F., the Pyralid, *Syngamia vibrusalis*, Wlk., the Tineid,

Acrocercops coerulea, Meyr., and the beetles, *Pagria aeneicollis*, Lef., and *Cneorane modesta*, Jac. In one locality coffee bushes were extensively defoliated by the Sphingid, *Cephonodes hylas*, L., and in another locality the berries were damaged to the extent of 90 per cent. by *Stephanoderes hampei*, Ferr. *Araecerus fasciculatus*, DeG., and the Tineid, *Brachyacma palpigera*, Wlsm., have been bred from coffee berries collected in the field. Rice was attacked by the Erotylid, *Anadastus filiformis*, F., the larvae of which bore into the top internode of the stem, the adults probably feeding on the pollen, the Coreids, *Riptortus linearis*, F., and *Cletus punctiger*, Dall., and the Pentatomids, *Tetroda histeroides*, F., and *Eusarcoris ventralis*, Westw. Pests of *Nipa fruticans*, of which *Parasa lepida*, Cram., is considered the most important, include the Hispids, *Wallacea palmarum*, Gestro, *Plesispa reichei*, Chap., and *P. nipa*, Maulik. Damage to *Areca catechu* was caused by *Mahasena corbetti*, *W. palmarum* and an unidentified Capsid, which is apparently the most important pest of this plant.

Insects attacking fruit trees included the Coreids, *Leptoglossus membranaceus*, F., on orange, and *Mictis tenebrosa*, F., on young shoots of lime ; the Noctuid, *Parallelia palumba*, Guen., which was recorded for the first time on grapefruit ; *Phytoscaphus leporinus*, Fst., and *Hypomeces squamosus*, F., on lemons ; *Stephanitis typicus*, Dist., on banana (*Musa sapientum*) and causing severe injury in one area ; *Papilio agamemnon*, L., and *Attacus atlas*, L., on soursop (*Anona muricata*) ; *Rhodoneura myrsusalis*, Wlk., and *Dacus* (*Chaetodacus*) *ferrugineus*, F., on *Achras sapota* ; *Attacus cynthia*, Drury, on guava ; and *Apogonia cribricollis*, Burm., *Adoretus* (*Lepadoretus*) *griseosetosus*, Nonfr., and *A.* (*Chaetadoretus*) *borneensis*, Kraatz, on *Nephelium lappaceum*.

Miscellaneous pests included *Helopeltis cinchonae*, Mann., and *Deilephila hypothous*, Cram., on *Cinchona* ; *Thermonotus oberthuri*, Rits., *Cricula trifenestrata*, Helf., *Leucoma submarginata*, Wlk., *Pingasa ruginaria*, Guen., *Theretra nessus*, Drury, and *Avitta rugifrons*, Moore, on cinnamon ; *Lamprosema camphorae*, Tams, *Stauropus alternus*, Wlk., and *Helopeltis cinchonae* on camphor; the Limacodid, *Miresa albipuncta*, H.-S., *Mahasena corbetti*, *Nygmia corbetti*, Tams., and *Boarmia transcissa lineataria*, Wlk., on *Aleurites montana* ; *Rhodoneura myrtaea*, Drury, on *Palaquium gutta* ; *Altha albiguttatus*, Snell., *Belippa lohor*, Moore, and *Zeuzera coffeae*, Nietn., on *Hydnocarpus* spp. ; *Eucosoma conciliata*, Meyr., *E. balanoptycha*, Meyr., *Remigia* (*Mocis*) *undata*, F., and *Homona coffearia*, Nietn., on derris ; *Pyrausta salentialis*, Snell., and *Pyroderces amphisaris*, Meyr., on maize ; *Homoeocerus serrifer*, Westw., *Physomerus grossipes*, F., *Omphisa anastomosalis*, Guen., and *Alucita niveodactyla*, Pag., on sweet potato (*Ipomoea batatas*) ; and *Ceratia* (*Rhaphidopalpa*) *similis*, Oliv., and *Leucinodes orbonalis*, Guen., on *Solanum melongena*. The Reduviid, *Sycamus leucomesus*, Wlk., was found preying on *C. similis*, *C. coffeae*, Hornst., and *C. atripennis*, F., on cucurbits.

Insects attacking *Solanum torvum*, which were investigated with a view to utilising them for the control of this weed in other countries, were *Leucinodes orbonalis*, Guen., *Epilachna indica*, Muls., *Dacus ferrugineus*, and *Phthorimea ergasima*, Meyr. The last-named damaged 60 per cent. of the berries, but also attacks *S. verbascifolium* and *S. melongena*, though it cannot be considered a pest in Malaya. In connection with the biological control of *Tirathaba rufivena*, Wlk.

(greater coconut spike moth), it is stated that its parasites in Malaya are the Ichneumonid, *Nemeritis palmaris*, Wlkn., and the Tachinid, *Erycia* (*Hemimasicera*) *basifulva*, Bezzi.

TOLLENAAR (D.). **Luis bestrijding.** [Insecticides against *Myzus persicae*, Sulz.].—*Meded. Proefst. vorstenl. Tabak*, no. 62, pp. 36–39. Klaten, Java [1929].

In tests of a number of sprays, chiefly proprietary preparations, against Aphids [*Myzus persicae*, Sulz.] infesting tobacco in Java, none proved so satisfactory as nicotine, if the effect on the flavour of the tobacco is considered as well as the toxicity to the Aphid. Nicotine is easily purchased at a definite strength or made from tobacco débris, and a spray of 1 per mille destroys the Aphids and does not affect the flavour of the tobacco to any noticeable extent. The addition of 2 per mille soap increases the insecticidal action, but affects the flavour of the tobacco, so that it is advised only for seed-beds or in the case of severe infestation. When soap is not added, the spray should be applied very thoroughly and repeated after 1–3 days.

ORDELHEIDE (C. H.). **Eén nieuwe bestrijdingswijze van de roode tabaksmier** (*Solenopsis geminata*) **op zaadbedden.** [A new Measure against the Red Tobacco Ant on Seedbeds.]—*Meded. Proefst. vorstenl. Tabak*, no. 64, 1 p., 1 pl. Klaten, Java [1929]. (With a Summary in English.)

To prevent the removal of seed from tobacco seed-beds by *Solenopsis geminata*, F., in Java, a piece of mosquito-net is stretched over the bed and sprinkled with water so as to be pressed on to the surface of the ground. This prevents the ants from reaching and removing the seeds. The net is left for about 4 days, until germination starts. Old netting with holes in it is quite effective.

NOYORI (C.) & KODERA (S.). *Janus japonicus*, **Sato, a Pest of** *Viburnum awabucki*. [*In Japanese.*]—*Insect Wld.*, xxxiii, pp. 363–368, 1 pl., 1 fig. Gifu, 1929.

Janus japonicus, Sato, has one generation a year in Japan, hibernating in the larval stage. The adult sawflies appear early in May and oviposit on young twigs of *Viburnum awabucki*, the eggs hatching at the end of the month.

GALLARD (L.). **Notes on the large mouse-grey Timber Moth** (*Zeuzera boisduvali*).—*Aust. Nat.*, vii, no. 1, pp. 3–4. Sydney, June 1927. [Received 1929.]

In New South Wales, the eggs of the Cossid, *Zeuzera boisduvali*, H.-S., are dropped on the soil at the base of gum trees [*Eucalyptus*], and the larvae, on hatching, crawl up the trunk and bore their way under the bark. One female, in captivity, laid over 16,000 eggs in four days. The larvae feed on the inner bark and sapwood of the tree, and pupate in their tunnels. The pupae are parasitised by Ichneumonids.

FROGGATT (W. W.). **Native Insects and introduced Trees.**—*Aust. Nat.*, vii, no. 1, pp. 12–14. Sydney, June 1927. [Received 1929.]

Golden wattle (*Acacia pycnantha*), when introduced from South Australia into New South Wales, was attacked by *Pachydissus sericus*, Newm., *Chrysolophus spectabilis*, F., *Laemosaccus querulus*, Pascoe, *Agrilus australasiae*, Lap. & Gory, *Bostrychopsis jesuita*, F., *Xylobosca bispinosa*, Macleay, *X. decisa*, Lesne, and *Xylodeleis obispa*, Germ. Other instances of insects that feed on indigenous trees attacking related introduced ones are *Diadoxus erythrurus*, White, a pest of the native *Callitris*, which does considerable damage to the allied *Cupressus lambertiana*; *Froggattia olivina*, Horv., a pest of *Notolaea longifolia*, which was found defoliating olives; and *Uracanthus cryptophagus*, Oll., which deserted the indigenous finger lime [*Citrus australasica*] for introduced species of *Citrus*.

ZECK (E. H.). **Notes on Aphididae (Homoptera). I.**—*Aust. Nat.*, vii, no. 7, pp. 137–139. Sydney, June 1929.

Macrosiphum (*Macrosiphoniella*) *sanborni*, Gill., and *Anuraphis helichrysi*, Kalt., are recorded, for the first time in Australia, on chrysanthemums in New South Wales. *Aphis nerii*, Boy., is found on the young shoots of oleander.

BURNS (A. N.). **The Golden Beetle** (*Calloodes mastersi* **Macleay), in the Mackay District.**—*Queensland Agric. J.*, xxxii, pt. 3, pp. 251–252. Brisbane, 1st September 1929.

The larvae of the Rutelid, *Anoplognathus parvulus*, Waterh. (*Calloodes mastersi*, Macleay), which are very abundant in some seasons in parts of the Mackay District, were definitely proved during 1928 and 1929 to attack the roots of sugar-cane. They seem to prefer fairly heavy scrub soils, and in the laboratory those in heavy soil appeared to be healthier and grew faster than those in sandy soil. The beetles, which feed on the leaves of various plants, were only found on the prickly cork tree (*Erythrina vespertilia*) in the Mackay District, sometimes defoliating a tree completely in the course of a few days. Their flight reached its maximum about 24th December and continued until the middle of January. They are particularly active in sunshine and are not readily attracted to light at night, the only individuals caught being males.

THOMAS (J. E.). **Dried Fruit Grubs—The Ethylene Dichloride-Carbon Tetrachloride Fumigation Process.**—*J. Council Sci. Ind. Res.*, ii, no. 3, pp. 128–133, 8 refs. Melbourne, August 1929.

A description is given of laboratory experiments carried out in Australia in fumigating against pests of dried fruit with a mixture of 3 parts by volume of ethylene dichloride and 1 of carbon tetrachloride. The results indicate that this mixture, at the rate of 14 lb. (5 quarts) to 1,000 cu. ft., is very toxic to the eggs, larvae and adults of *Plodia interpunctella*, Hb. The length of exposure in each test was 22 hours, and the temperature was maintained at 70° F. In the case of the eggs, the tests were prolonged over a period of 73 days in order to allow of any possible variation in the viability of the batches. The mixture does

not appear to be toxic to the eggs of *Silvanus surinamensis*, L., a secondary pest of minor importance. A high lethal effect was obtained with buried larvae of *Plodia*, even with 7 lb. to 1,000 cu. ft. The question of penetration is of great importance in the case of the larvae, which may be found in the centre of packed fruit. The pupae usually occur close to the outer surface, and almost all the eggs are deposited on the container and package, pre-packing infestation being relatively unimportant [*R.A.E.*, A, xvii, 268]. Experiments on a commercial scale in the fumigating chamber commonly used in packing sheds, which is not completely airtight, to confirm the results secured, were only partly successful. Further tests were carried out in an airtight steel drum of 125 cu. ft. capacity filled with boxes of currants, placed on battens to allow of free circulation of the fumigant, which was sprayed through apertures in the top. After 22 hours' exposure, all larvae of *Plodia* in the smaller boxes were killed. In the large (56 lb.) boxes all the larvae were dead when examined a month later, except in the box situated at three-quarters of the height of the drum, in which 4 per cent. had pupated. Eggs of *Silvanus* were not affected. The temperature during the fumigation period varied between 68 and 92° F.

[MONTE (O.).] **Combate á cigarrinha dos cannaviaes.** [Combat the Sugar-cane Froghopper.]—*Chacaras e Quintaes*, xl, no. 4, pp. 407–408, 3 figs. S. Paulo, 15th October 1929.

A brief description is given of *Tomaspis indentata*, Wlk., which attacks sugar-cane in the Brazilian state of Minas Geraes. It oviposits in the aerial parts, whereas *T. liturata*, Lep. & Serv., usually prefers the base of the cane or the roots. The life-cycle requires 2 months. Burning the infested leaves and the use of light traps are the measures advised ; but if the attack is very severe, the growing of cane or other graminaceous plants may have to be abandoned.

NEWELL (W.). **Comments on Entomology in the South during the past twenty-five Years.**—*J. Econ. Ent.*, xxii, no. 5, pp. 732–735.

THOMAS (F. L.). **What does the Future hold in Store for the South ?**—*T.c.*, pp. 736–743. Geneva, N.Y., October 1929.

The first of these two papers is a brief, general review of the progress of entomology in the Southern States since 1904, in which the chief pests are mentioned, together with some of the more important control measures adopted. In the second are discussed the dangers particularly threatening these 11 States, in which 44 of the 51 important farm crops produced in the United States are cultivated, with an estimated value in 1928 of £552,332,000 or one-third of the total agricultural wealth of the country, and which are signally exposed to inroads from new pests. A comparison of inspection records from southern ports for the fiscal years ending 1927 and 1928 shows an increase of 35 per cent. in the number of ships arriving, and 50 per cent. in the number of interceptions. In 1928, 477 insects, representing at least 150 species, were intercepted in the Southern States, one-sixth of these being taken on the Texas border, which is nearly 1,000 miles long and offers many opportunities for the introduction of pests. Rapidly increasing facilities of transport are rendering the accidental importation of insects progressively easier, and natural barriers that have hitherto prevented the distribution of insect pests are fast disappearing. The spread of

the pink bollworm [*Platyedra gossypiella*, Saund.] from Mexico by natural means [see next paper] is likely to increase with agricultural development, and infestations of other pests will probably result in a similar manner. The reduction from full yield per acre of cotton in the Southern States, caused by injurious insects, shows an average for three 5-year periods of 9 per cent. in 1911–1915; 15·7 per cent. in 1916–20; and 21·3 per cent. in 1921–25. In the last of these periods the average reduction that was due to the boll-weevil [*Anthonomus grandis*, Boh.] was 17·3 per cent.

Suggested measures include strengthening of the inspection service; extension of investigations; more intensive training of a greater number of men for entomological work; and increased co-operation, particularly of an international nature. Additional studies of insect ecology in regard to pests already established should be made in both summer and winter, and the possibilities of the biological control of insects likely to be imported should be studied before they arrive in the country.

Coad (B. R.). **Organization and Progress of Pink Bollworm Research Investigations.**—*J. Econ. Ent.*, xxii, no. 5, pp. 743–750, 3 refs. Geneva, N.Y., October 1929.

Platyedra (*Pectinophora*) *gossypiella*, Saund., which although present in the United States for more than 10 years, has hitherto occurred there in numbers only great enough to call for preventive or eradicatory measures, has now become sufficiently abundant in south-western Texas to warrant local investigations of its bionomics. These were therefore begun in 1928, the headquarters of the work being at El Paso, with several field laboratories in south-western Texas and northern Mexico. The work in hand includes studies of hibernation and flight, gin trash disposal, cultural control methods and auxiliary food-plants.

Some of the most interesting results hitherto secured have been in connection with the migratory habits of the moths. In view of increasing indications that flight was an important factor in spread, 9 trap plantings of cotton were arranged at distances varying from 40 to 75 miles from the nearest cotton fields. At the end of the season 8 of these were found to be infested with *P. gossypiella*. A further series of studies, which included regular observations of moth abundance at a number of points covering a distance 300–400 miles north and south, records of seasonal abundance in the various planting districts, trap plantings, migration screens and the use of aeroplanes equipped with insect collecting traps, showed that the moths have a distinct migratory period, starting about 1st September, and continuing till the appearance of frost. Since aeroplane collections showed the presence of moths at considerable altitudes in the upper air, the possible importance of wind as a factor in spread must not be overlooked. Studies of infestation in western Texas over a period of several years show a close correlation between bollworm activity there and the amount of windiness in the cotton-growing districts in northern Mexico during the month of September. The comparatively low wind record in northern Mexico during September 1928 was accompanied by a considerable diminution in infestation in the United States.

The larvae of *P. gossypiella* have been known to survive in the winter resting stages and occasionally to pupate on food-plants other than cotton in non-cotton zones established for purposes of eradication.

Repeated tests made with the idea of re-establishing infestation from these food-plants either on the same plants or on cotton in the spring have given consistently negative results, but one of the most significant observations was the contrast secured in open fields in two areas in Texas. In the first, which, after having been heavily infested in 1927, was made a non-cotton area in 1928, self-sown cotton became heavily infested before it was destroyed in the latter year. Okra [*Hibiscus esculentus*] and *Thurberia*, which had been heavily infested in the presence of cotton in 1927 in this area, showed no sign of infestation in 1928 in the absence of cotton, although in the other area under observation both okra and hollyhock, with cotton present, became infested as usual in that year. Biological investigations indicate that these plants may be incapable of serving as continuous food-plants for *P. gossypiella*, but must be reinfested from cotton. Studies of hibernation showed that 90 per cent. of the emergence took place before cotton was available for food, whereas 99 per cent. mortality among the over-wintering stages was produced by winter ploughing followed immediately by winter irrigation, these operations having little effect at other seasons. Spring irrigation was observed to stimulate emergence.

DUNNAM (E. W.). **Experiments on the Relation between the Location of Cotton Fields and the Intensity of Boll Weevil Infestation the succeeding Season.**—*J. Econ. Ent.*, xxii, no. 5, pp. 750–756, 3 graphs. Geneva, N.Y., October 1929.

Experiments on the migratory habits of the cotton boll weevil [*Anthonomus grandis*, Boh.] were carried out in Louisiana in 1928 by means of screen traps under conditions that were peculiarly favourable, as floods in 1927 had destroyed large areas of cotton. Observations were carried out both in fields where cotton had been grown in 1927 and also in cotton situated at varying distances up to 3 miles from the site of an isolated extensive cotton planting of that year. Additional tests were made in woods and in an unplanted field a mile away from the site of this planting. The screens, which were treated with adhesive, were set up between 28th May and 2nd June, and observed daily. Records were kept to determine the effect on dispersal of relative abundance of weevils, supply of food and distance from breeding-places, and height of the cotton plants. The results secured, though not conclusive, indicate that there was no relation between the spring infestation in 1928 and the situation of scattered cotton plantings in 1927, though distance from a supplementary source of weevils may be an important factor in early spring infestations.

FLETCHER (R. K.). **The uneven Distribution of** *Heliothis obsoleta* **(Fabricius) on Cotton in Texas.**—*J. Econ. Ent.*, xxii, no. 5, pp. 757–760. Geneva, N.Y., October 1929.

Some of the possible causes of the conspicuous unevenness of distribution of injury to cotton by *Heliothis obsoleta*, F., in Texas, where it is relatively uniform on maize, are briefly discussed. Quaintance and Brues (*U.S. Dept. Agric. Bur. Ent. Bull.* no. 50, 1905) observed the moths to be noticeably more abundant after soaking rain. They point out that the supply of nectar, which constitutes the food conditional to oviposition, would be less plentiful during periods of drought,

and that parasitic and predacious enemies of the moth are much more active during dry than during rainy weather, *Trichogramma minutum*, Riley, in particular, being not only rendered inactive, but probably destroyed in large numbers by rain. Uneven distribution of rainfall, therefore, is one of the probable causes of inequality in injury by *H. obsoleta*. Variations in the type of soil in which cotton is grown resulting in a lack of uniformity in the quantity of nectar produced is another probable factor, since the moths are attracted to the plants producing most nectar. An experiment to determine whether the moths are attracted by other sweet substances indicated that a bait of equal parts of molasses and water is attractive when sprayed on the plants. Another possible attracting agent is the honeydew produced by Aphids [*Aphis gossypii*, Glov.], which often infest cotton that has been dusted with calcium arsenate [*R.A.E.*, A, xvi, 268]; an instance has been observed of infestation by *H. obsoleta* increasing after calcium arsenate had been applied.

EWING (K. P.). **Effects on the Cotton Plant of the Feeding of certain Hemiptera of the Family Miridae.**—*J. Econ. Ent.*, xxii, no. 5, pp. 761–765, 3 pls., 4 refs. Geneva, N.Y., October 1929.

Experiments with six Capsids, four of which, *Psallus seriatus*, Reut., *Lygus pratensis*, L., *Adelphocoris rapidus*, Say, and *Creontiades debilis*, Van D., are known to infest and injure growing cotton, whereas the other two, *Poeciloscytus basalis*, Reut., and *Lygus apicalis*, Fieb., have not hitherto been recorded as pests of this plant, showed that each of these species, when allowed to feed in cages on cotton plants, caused the young squares to be shed or become blasted, produced lesions along the main stem, branch stems and leaf petioles, and caused mutilation of the leaves. The Capsids are mentioned in order of the importance of the injury caused by them. The experiments with *C. debilis* were carried out in Texas in 1925; those with the remaining species in Louisiana in 1928. Brief references are made to the literature concerning some of the species, and the technique of the experiments and the data secured from them are discussed in detail. Internal and external examination of the lesions showed only local injury, which seldom extended more than 2 mm. and never more than 5 mm. from the point of puncture.

REINHARD (H. J.). **The Value of Spring Emergence Records on the Cotton Flea Hopper,** *Psallus seriatus*.—*J. Econ. Ent.*, xxii, no. 5, pp. 765–768. Geneva, N.Y., October 1929.

An examination of data relating to the spring emergence of *Psallus seriatus*, Reut., in Texas from 1926 to 1928 indicates that a heavy spring emergence is not always necessarily followed by severe injury to cotton, infestations being apparently determined by the status of the crop at the time when the maximum of the spring emergence is reached. Low temperatures and excessive rainfall during March 1926 retarded emergence of *P. seriatus* until 15th April, when the cotton had come up generally in the field, and unprecedented injury to the crop resulted during the season. The maximum of a

heavy emergence in 1927 and that of a lighter emergence in 1928 occurred during March, with approximately normal temperature and rainfall in both years. Very little young cotton was available in the field at this time and little or no subsequent injury to the crop resulted.

HINDS (W. E.). **Preliminary Studies regarding Physical Qualities and Distribution of Sodium Silicofluoride Dusts.**—*J. Econ. Ent.*, xxii, no. 5, pp. 768–773. Geneva, N.Y., October 1929.

The following is taken from the author's abstract : Field experiments with sodium silicofluoride dusts applied to maize and sugar-cane for control of the sugar-cane borer [*Diatraea saccharalis*, F.] have been conducted at the Louisiana Experiment Station during the seasons 1925, 1926 and 1927. These tests have shown that there exists in different brands and mixtures of these dusts such great variations in dusting qualities as to indicate that physical texture, free flowing qualities, lightness, etc., may be as important as its chemical character in determining the insecticidal value of a dust.

This article deals with a preliminary study of some of these physical qualities and their effect upon the distribution of the dust through the dust swath. The method of comparing the dusts is described, and the results obtained in a series of 24 tests with 8 different materials are shown. The study includes comparisons of the quantity of dust deposited per 1,000 sq. ins. of area at points 15, 30, 45, 60 and 90 feet from the outlet of the dusting machine. The character of particles deposited is shown visually through micro-photographs and photo-prints made for the dust sample at each distance. Chemical analyses indicate considerable separation of the sodium silicofluoride particles from hydrated lime particles when such a mixture is blown out and spread by air current to a considerable distance. These studies can be correlated also with field records on borer control and foliage injury on sugar-cane.

HULL (F. M.). **The Plant Louse Problem of the Texas Gulf Coast.**—*J. Econ. Ent.*, xxii, no. 5, pp. 774–777. Geneva, N.Y., October 1929.

In one of the important vegetable-growing centres along the Gulf coast of Texas, low temperature and high winds render ineffective standard control measures against various Aphids, including *Aphis pseudobrassicae*, Davis, and *Pemphigus populitransversus*, Riley, which cause serious damage to crucifers. Attempts to discover a satisfactory method of control have included experiments in fumigation beneath cheap tar paper covers, in which calcium cyanide, at a dosage of 0·0285 oz. to 70 cu. ft. with an hour's exposure, proved the most successful fumigant. A method of heating nicotine sprays and dusts by means of a small petrol heater attached to the spray tank or dust gun appears to offer promising results in localities with cool temperatures in the growing season. By this means it is hoped to lessen the cost of spraying by increasing the lethal effects of the same dilution, admitting of the use of greater dilutions, or lessening the total amount of spray used and consequently reducing the time required for application.

STEWART (M. A.). **The Teaching of Entomology.**—*J. Econ. Ent.*, xxii, no. 5, pp. 777–781. Geneva, N.Y., October 1929.

The course described is drawn up with the object of providing a thorough training in the fundamentals of entomology that may combine the creation of an intelligent public interest in the work with attracting the type of student suitable to enter the profession.

MOZNETTE (G. F.). **Poor Results secured in some preliminary Airplane Dusting of Pecans for the Control of the Pecan Leaf Case-bearer.**—*J. Econ. Ent.*, xxii, no. 5, pp. 781–782. Geneva, N.Y., October 1929.

The results secured in experiments in the spring of 1928 against *Acrobasis palliolella*, Rag. (pecan leaf case-bearer) showed no appreciable difference between the percentages of infested buds in trees dusted from aeroplanes and in untreated trees. The average number of hibernacula found was 0·36 per bud on the dusted grove as compared with 0·44 per bud on the controls. In dusting pecan trees 30 feet in height by aeroplane with a dust containing 10 per cent. of lead arsenate, even when applied at the rate of 80 lb. to the acre, there is apparently too great a dispersion of the dust cloud to secure effective control against *A. palliolella*. This difficulty might be overcome by increasing the percentage of lead arsenate in the dust mixture or by the adaptation of the dusting equipment used so as to apply a larger amount of dust.

SNAPP (O. I.) & SWINGLE (H. S.). **Results of further Investigations with Paradichlorobenzene around Peach Trees, with special Reference to Injury.**—*J. Econ. Ent.*, xxii, no. 5, pp. 782–785. Geneva, N.Y., October 1929.

This paper gives the results of experiments conducted in Georgia in 1928 with paradichlorobenzene for the control of the peach borer [*Aegeria exitiosa*, Say] in continuation of those carried on since 1923 [*R.A.E.*, A, xvi, 454]. The high temperatures prevailing in the warmest October for the past nine years caused a rapid generation of the gas. Severe injury resulted after 2–4 weeks' exposure to a ¼ oz. dose in peach trees 1, 2 and 3 years old, many of which were expected to die. Little injury, and that mainly confined to the bark layers, was caused to the older trees by the appropriate doses [xvi, 455].

Paradichlorobenzene dissolved in petrol as suggested by Siegler and Brown [xvi, 122 ; xvii, 381] failed to control *A. exitiosa* in Georgia in October, possibly owing to the nature of the soil (Orangeburg clay).

HOIDALE (P. A.). **The Mexican Fruit Worm Situation.**—*J. Econ. Ent.*, xxii, no. 5, pp. 786–789. Geneva, N.Y., October 1929.

A brief account is given of the work carried out in Texas against the Mexican fruit worm [*Anastrepha ludens*, Lw.] since 1927 [*R.A.E.*, A, xvi, 505, etc.]. Intensive inspection has failed to reveal any infestation in the *Citrus* crops of 1927–28 and 1928–29. The operation of the quarantine [xv, 668] has been maintained, and more than 99 per cent. of all secondary host-fruit trees have been destroyed by voluntary co-operation of the growers, thus ensuring the almost perfect preservation of a host-free period. All host trees have also been cleared of

fruit on the Mexican side of the frontier over an area extending from the Gulf about 100 miles up the Rio Grande Valley. The inauguration of the quarantine has resulted in better condition of the orchards and the production of a higher grade of fruit.

CLARK (S. W.). **Insect Pests affecting commercial Crops in the Lower Rio Grande Valley.**—*J. Econ. Ent.*, xxii, no. 5, pp. 789–792. Geneva, N.Y., October 1929.

A popular account is given of the insect pests affecting cotton, vegetable crops and *Citrus* in the lower Rio Grande Valley of Texas, the more important of which include : the cotton leaf worm [*Alabama argillacea*, Hb.], which migrates to vegetable crops from cotton and has recently caused severe damage to cabbage, etc ; the bean leafhopper [*Empoasca fabae*, Harr.], which transmits bacterial blight to beans ; *Diabrotica* spp. on cucurbits; the turnip Aphid [*Aphis pseudobrassicae*, Davis] ; and the onion thrips [*Thrips tabaci*, Lind.], for which all control measures tried have hitherto proved ineffective. *Citrus* is attacked by a number of Coccids, the most serious of which is the California red scale [*Chrysomphalus aurantii*, Mask.], and by the rust mite [*Phyllocoptes oleivorus*, Ashm.], which is, however, easily controlled by two applications either of sulphur dust or of lime-sulphur spray combined with two oil sprays. The cotton bucculatrix [*Bucculatrix gossypiella*, Morrill] has recently appeared in Texas on cotton [*cf.* *R.A.E.*, A, xv, 394]. The introduction of new pests in the Rio Grande Valley is likely at any time owing to the proximity of Mexico and the prevailing south-east winds.

HULL (F. M.). **Some possible Means of Control of the Damage caused by the Cotton Leaf Worm Moth to the Fig.**—*J. Econ. Ent.*, xxii, no. 5, pp. 792–796. Geneva, N.Y., October 1929.

Severe damage to figs was caused in Texas by *Alabama argillacea*, Hb. (cotton leaf worm) in 1926, when the moths settled in swarms on the fruit, which subsequently became sour. The moths feed at the open end of the figs, the damage sometimes amounting to 80 per cent. In 1927 no outbreak occurred, but in 1928 the larvae were numerous in cotton fields adjacent to figs, and 15,000 pupae were collected for use in experiments with poison baits and repellents. The baits, most of which were effective in cages, consisted of sodium arsenite at the rate of ½ lb. to 25 lb. of bulk carrier composed of fig mash, or fig and molasses syrups, sometimes combined with bran. The mashes and brans were encased in rough cheesecloth sacks, and strips of flannel and sacking were soaked in the syrups and suspended from the tops of the cages. A choice of baits and a number of normal figs were offered to the moths, 100 of which were placed in each cage, and the numbers dying each day were counted for 3 days. A yeasty fig mash gave the highest kill on the first day (86) and a total kill in three days of 97. A suitable method of applying these baits during outbreaks of *A. argillacea* has yet to be devised. Of the materials tested as repellents on figs, pine tar oil proved more effective than cade oil, but the effect of both wore off in 24 hours. The last of 100 moths confined with an abundant food supply died in 27 days ; without food the total number of days was 11. Maximum feeding by the moths took place just before dark. Feeding is apparently intermittent and lasts only a few

minutes. Although it was rare to find more than a dozen moths feeding at once, the poison experiments showed that the majority of the moths fed at least once during the night.

LYLE (C.). **Further Tests of Cutworm Bait Poisons.**—*J. Econ. Ent.*, xxii, no. 5, pp. 797–798. Geneva, N.Y., October 1929.

This is a fuller account of work already noticed [*R.A.E.*, A, xvii, 524] and includes a table showing the number of cutworms of various species killed by each type of bait.

DANIEL (D. M.). **Technique employed in transferring Parasites of the Oriental Peach Moth** (*Laspeyresia molesta* **Busck**).—*J. Econ. Ent.*, xxii, no. 5, pp. 801–805. Geneva, N.Y., October 1929.

A comparison of two methods of handling parasitised material of *Cydia* (*Laspeyresia*) *molesta*, Busck, in sending *Macrocentrus ancylivora*, Roh., from New Jersey to New York showed that it is preferable to retain the material at the place of collection until the larvae have reached the pupal stage. A total emergence of 15·03 per cent., of which 48·56 per cent. were parasites, was secured from the larvae of *C. molesta* in peach twigs despatched to their destination immediately upon collection, whereas material kept in jars and transferred only after the cocoons had been spun on corrugated cardboard showed a total emergence of 32·43 per cent., of which 68·69 per cent. were parasites. Both series were collected over approximately the same period and from the same orchard.

YOTHERS (M. A.). **Observations on some of the more important Insects captured in Codling Moth Trap Baits.**—*J. Econ. Ent.*, xxii, no. 5, pp. 805–811, 1 ref. Geneva, N.Y., October 1929.

An account is given of the insects caught in the course of experiments with bait traps for *Cydia* (*Carpocapsa*) *pomonella*, L., in Washington [*R.A.E.*, A, xvi, 80]. The baits were suspended in wide-mouthed fruit jars, or in tin or enamel containers, attached to a cord run through a screw eye in a horizontal limb in the topmost part of the tree. They consisted of either an apple ferment made from 3 lb. chopped apple and 3 U.S. gals. water, to which 3 lb. brown sugar and 6 cakes of fresh yeast were added after cooking, and allowed to ferment 5–6 hours, or of ferments made by diluting honey or molasses with 10 parts water and adding 1 cake of yeast.

In one of the experiments, in which the jars were filled with the apple ferment on 16th April and examined every 3 days until 23rd September, *Chrysopa* spp. were taken in small numbers until early in July, after which they were increasingly abundant until early September and then decreased rapidly; *Hypsopygia costalis*, F., began visiting the baits at the end of May, reached a maximum on 10th July and then gradually decreased; and *Tortrix* (*Cacoecia*) *rosaceana*, Harr., was apparently present throughout the season from 20th May onwards, but in very small numbers. Bees were captured only during the first few days after the blossoms had fallen. *C. pomonella* was present from 26th April to 20th September in varying numbers, according to the condition of the brood and the temperature. These results were more or less confirmed by 11 other tests, which also showed the greatest

abundance of Noctuids during the last week in August and the first week in September. More insects were captured in cooked than in raw apple ferments. Vinegar was the least satisfactory bait used. Molasses, apple and honey ferments proved the three best baits, and enamelled kettles or pans the best containers. *Chrysopa* spp., Noctuids, *T. rosaceana*, and *C. pomonella* were caught in the largest numbers in the molasses ferment pans, but *H. costalis* appears to prefer apple or honey ferments.

VAN DER MEULEN (P. A.) & VAN LEEUWEN (E. R.). **A Study of the insecticidal Properties of Soaps against the Japanese Beetle.**—*J. Econ. Ent.*, xxii, no. 5, pp. 812–814. Geneva, N.Y., October 1929.

Experiments against the Japanese beetle [*Popillia japonica*, Newm.,] were made with a number of different sodium and potassium soaps, the oils and fats from which they were made including both animal and vegetable products belonging to the groups of drying, semi-drying and non-drying oils. The soaps were prepared from the oils and fats by saponifying with sodium hydroxide solution, separating the unsaponifiable material and acidifying the soap solution with dilute sulphuric acid. The separated fatty acids were washed repeatedly with hot water and a suitable portion weighed and treated with the calculated quantity of sodium or potassium hydroxide, which was dissolved in water. The solution was warmed until homogeneous and placed in sealed glass jars, each stock sample consisting of about 450 gm. soap and 1,000 gm. water. In most cases solutions could be prepared from this stock containing as much soap as corresponds to 6 lb. to 50 U.S. gals. water. Where the solubility was too low for this, the solution was used with some soap in suspension. A drenching spray was applied with a hand sprayer in cages in each of which approximately 100 beetles were confined. Unsprayed smartweed plants were used for food, and the percentages of kill were determined after 24 and 48 hours. The percentages of kill 24 hours after the application are tabulated as a basis of comparison, taking into account the percentage of beetles that died in control cages. The best result of 85 per cent. mortality was secured with sodium soap made with coconut oil, whereas palm oil gave 73 per cent. with sodium and 70 per cent. with potassium soap. In view of surprising variations in the percentage of mortality shown in the results, and the fact that variations of temperature appeared to exert considerable influence over the kill, attempts to correlate insecticidal properties with the chemical and physical properties of the soaps have been postponed until further data have been collected.

CARTER (R. H.). **Compatibilities of Insecticides. I. Fluosilicates and Cryolite with Arsenates.**—*J. Econ. Ent.*, xxii, no. 5, pp. 814–818. Geneva, N.Y., October 1929.

The following is largely taken from the author's conclusions : Tests to determine the compatibilities of arsenates with fluosilicates or cryolite were made by mixing the materials in the ratio of 1 lb. each to about 46 U.S. gals. water (2 gm. to 800 cc.), mechanically shaking for half an hour, allowing to stand 24 hours at 20° C. [68° F.], and analysing samples of the solutions for soluble arsenic and acidity. Lead arsenate may be mixed in water with the fluosilicates of sodium, potassium,

barium and calcium without the formation of excessive amounts of soluble arsenic. With the exception of a commercial compound, containing only 8·6 per cent. calcium fluosilicate, the arsenates of calcium, manganese, magnesium, aluminium and barium were largely decomposed by the presence of fluosilicate. Barium fluosilicate caused the formation of smaller amounts of soluble arsenic than the other fluosilicates. Magnesium and aluminium arsenates were very slightly affected, but calcium, manganese and barium arsenates were greatly decomposed when mixed with barium fluosilicate in water. The presence of cryolite slightly decreased the formation of soluble arsenic with all the arsenates used. None of the arsenates developed excessive amounts of soluble arsenic on standing in tap water for 24 hours.

SIMMONS (P.). **Henri Louis Duhamel du Monceau: a Pioneer Economic Entomologist.**—*J. Econ. Ent.*, xxii, no. 5, pp. 820–821, 1 portrait. Geneva, N.Y., October 1929.

A brief account is given of the investigation by Duhamel du Monceau of a severe outbreak of *Sitotroga cerealella*, Ol., in France in 1761.

NEWCOMER (E. J.) & YOTHERS (M. A.). **Sterility in the San José Scale.**—*J. Econ. Ent.*, xxii, no. 5, pp. 821–822. Geneva, N.Y., October 1929.

Repeated examinations of pear trees that had been sprayed with lime-sulphur in the spring against San José scale [*Aspidiotus perniciosus*, Comst.] throughout the season in 1923 and again in 1925 showed an almost entire absence of young on the trees and of embryos in the females, although many of the latter were still found alive even in August and September. The same condition was noted in 1926 and 1927 on apple trees sprayed late in March, some adult females remaining alive until September. These observations may account for the success of lime-sulphur in controlling *A. perniciosus* in spite of the fact that actual examinations of the Coccids a month or so after spraying rarely show complete mortality.

SWINGLE (H. S.). **The Storage of liquid Lime Sulfur in Steel Drums.**—*J. Econ. Ent.*, xxii, no. 5, p. 822. Geneva, N.Y., October 1929.

The practice of keeping liquid lime-sulphur in steel drums causes a slow reaction resulting in the production of ferrous sulphide. The precipitated ferrous sulphide is finely divided and remains in suspension for considerable periods, giving the solution a dark brown colour. The only injurious effect upon the lime-sulphur, however, consists in the removal of small quantities of sulphur from solution, thus weakening its insecticidal properties. As the Baumé density is only reduced 0·2° during 4 months' storage and 0·6° during a year, the quantity of sulphur removed is apparently slight.

ALDEN (C. H.). **Sulfur a Repellent to** *Trichogramma minutum*.—*J. Econ. Ent.*, xxii, no. 5, p. 822. Geneva, N.Y., October 1929.

Applications of sulphur, which completely eliminated Gamasid mites infesting incubators used for the artificial rearing of *Sitotroga*

cerealella, Ol., to obtain eggs for breeding the parasite, *Trichogramma minutum*, Riley, although they caused no ill-effects to the moths, rendered their eggs toxic to the adult parasites, which became sluggish and died in 24 hours, none of the host eggs being parasitised.

TISCHLER (N.). **Geraniol Bait as a possible Attractant for Cicadadae.**—*J. Econ. Ent.*, xxii, no. 5, p. 823. Geneva, N.Y., October 1929.

In the course of work against the Japanese beetle [*Popillia japonica*, Newm.], it was observed that numbers of common dog-day cicadas [*Tibicen canicularis*, Harr.] were attracted by the geraniol bait used in the traps. This bait may prove of value against the 17-year cicada [*T. septemdecim*, L.] in regions where that insect is likely to be prevalent.

LIPP (J. W.). **Notes on Experiments on Ovipositional Chemotropism.**—*J. Econ. Ent.*, xxii, no. 5, pp. 823–824. Geneva, N.Y., October 1929.

Further details are given in relation to a brief account of experiments already noticed [*R.A.E.*, A, xvii, 184] from which the names of the insect and the chemical used were omitted.

The presence of garlic on a golf course, the turf of which had been destroyed by *Popillia japonica*, Newm., suggested the possibility that allyl sulphide, which has a garlic-like odour, might attract the adult beetles to oviposit in the vicinity. Allyl sulphide undiluted proved too strong, but numbers of eggs were laid near a cup containing a 2 per cent. solution of allyl sulphide and grain alcohol, few or none being found near the plain alcohol used as a control in the same cage. Similar results were secured with a 1 per cent. solution. If the same result could be obtained with allyl sulphide or any other chemical under field conditions, this would constitute a valuable control measure used in conjunction with poisoned soil.

SNAPP (O. I.) & SWINGLE (H. S.). **Relative covering Power of Miscible Oil and Oil Emulsion.**—*J. Econ. Ent.*, xxii, no. 5, p. 824. Geneva, N.Y., October 1929.

Experiments were made with a commercial miscible oil that was stated to be capable of spraying from 2 to 2½ times as many trees as a diluted oil emulsion, but it was not found more effective than the latter in this respect.

SMITH (F. F.). **Some Life Habits of *Aphis rubiphila* Patch.**—*Proc. Pennsylvania Acad. Sci.*, i (1924–26), pp. 83–84. Harrisburg, Pa., 1926. [Received 1929.]

A brief account is given of observations in Pennsylvania on *Aphis rubicola*, Oestl. (*rubiphila*, Patch), which is the vector of mosaic and leaf-curl of raspberries. The winter eggs are deposited on raspberry canes, in the axils of the buds, in crevices of the bark or in parts attacked by Anthracnose, and hatch in early April, when the leaves are just separating from the buds. The young stem-mothers crawl to the buds and soon settle down at the base of the new growth, where reproduction takes place and compact colonies of nymphs form about them. Winged individuals appear in the second and third generations, and in

the fourth they are numerous, and a sudden general dispersal takes place to the lower leaf surfaces, where feeding continues for the rest of the summer. Very few winged individuals develop on the leaves during the summer, and by about 1st November the wingless sexual forms are mature, pairing occurs on the leaves, and the females descend the petioles to oviposit, dying shortly afterwards. There are probably 10 or 12 distinct generations in a season, 4 at the base of the spring growths and 6 or 7 on the leaves. The spring forms produce from 32 to 36 young in each generation; those on the leaves 6 or 7. Predators such as *Hippodamia convergens*, Guér., and *Adalia bipunctata*, L., and the Braconid parasite, *Aphidius* sp., generally reduce the apterous individuals in the colonies, so that few are present at the time of dispersal.

STEAR (J. R.). **Insect Prediction Hazards with particular Reference to the Leaf-hopper,** *Empoa pomaria* **McA.**—*Proc. Pennsylvania Acad. Sci.*, ii (1927–28), pp. 54–58. Harrisburg, Pa., 1928.

The factors to be considered in attempting to predict outbreaks of insects are the numbers present at the time of prediction, which can be ascertained quite accurately in the case of most pests that pass the winter as eggs on the trees, the reproductive capacity of the insect, meteorological conditions, and natural enemies. As the last two of these factors are variable, it is impossible to predict whether an insect with high reproductive capacity will or will not be injurious because it is abundant or scarce early in the season. An insect such as *Lygidea mendax*, Reut. (light apple red bug), however, does not increase rapidly or vary much in numbers from year to year except under the effects of spraying. The eggs are under the bark and are difficult to detect, but they hatch a day or two before the blossoms open, and if the trees are examined at blossom time for injury to the terminal leaves by the young nymphs, it can be definitely determined whether nicotine sulphate should be added to the petal-fall spray. Much attention has been given to attempts to predict the incidence of one of the leafhoppers on apple in Pennsylvania, *Typhlocyba* (*Empoa*) *pomaria*, McA. Observations in 1924 showed that as many as nine leafhoppers to each leaf in the first generation and 12 in the second did not result in sufficient damage to warrant special spraying. In the spring of 1926, a count of eggs indicated considerably lower infestation than this, and no spray was applied. Unfortunately, severe injury occurred owing to the unexpected presence of three other species of leafhopper on the trees, namely, *Erythroneura harti*, Gill., *E. obliqua*, Say, and *E. lawsoni*, Baker (*dorsalis*, Gill.). Since these species overwinter as adults, it would be impossible to predict their numbers by examining the twigs, but the author believes that the possibility of damage from *T. pomaria* alone could be quite accurately determined.

STICHTER (G. B.). **Incidental Effects following certain Greenhouse Practices in Control of the Japanese Beetle.**—*Proc. Pennsylvania Acad. Sci.*, ii (1927–28), pp. 58–60. Harrisburg, Pa., 1928.

The quarantine regulations in Pennsylvania against the Japanese beetle [*Popillia japonica*, Newm.] require that all soil, sand and manure used in greenhouses shall have been fumigated with carbon bisulphide

and stored under conditions that will prevent reinfestation by adult beetles and grubs, and that ventilators and other openings must be screened between 15th June and 15th October with metal screening of a mesh not larger than 8 to the inch. The effect of carrying out these regulations on infestation by other insects is discussed. As an effect of screening, some growers report freedom from Aphids, *Diarthronomyia hypogaea*, F.Lw. (chrysanthemum midge), *Tortrix* (*Cacoecia*) *rosaceana*, Harr., and whitefly [*Trialeurodes vaporariorum*, Westw.]. Fumigation of the soil was generally considered advantageous in controlling cutworms and *Lachnosterna* (*Phyllophaga*) sp., as well as weeds and earthworms.

Heinrich (C.). **Two new American Coleophoridae (Lepidoptera).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 1, pp. 18–19. Washington, D.C., January 1929.

Coleophora salmani, sp. n., is described from birch in Mt. Desert Island, Maine, and *C. sparsipuncta*, sp. n., from aster in Indiana.

Salman (K. A.). **Notes on the immature Stages and Biology of a Birch Case-bearer.**—*Ann. Ent. Soc. Amer.*, xxii, no. 3, pp. 480–488. Columbus, Ohio, September 1929.

Almost complete defoliation of white and grey birches (*Betula alba* and *B. populifolia*), observed in Mt. Desert Island, Maine, in 1927 and 1928, was found to be due to *Coleophora salmani*, Heinrich [see preceding paper]. Apart from this relatively heavy infestation, the moth has been observed in two localities on the mainland. The immature stages and larval cases are briefly described. There is only one generation a year, the eggs being laid about the middle of July and hatching early in August. The larvae, the habits of which are described in detail, first feed between the epidermal layers of the leaf, and subsequently form their cases from the layers of the area mined. They hibernate in them on the twigs of the tree, and begin their feeding activities again in the following spring, the majority pupating early in July on twigs on the tree or plants under it. The pupal stage lasts 14–15 days. The adults, which live for 6–10 days, generally remain in sheltered positions during the daytime, often on the lower surface of the leaves. One female was observed to lay a total of 39 eggs over a period of 7 days, 20 being deposited on the first day. In the field, eggs only occurred on the lower surface of the leaves, being observed on *Corylus americana* and *Alnus* sp., though *Betula alba* appears to be preferred. None was found on *B. populifolia.* As many as 33 may be laid on a single leaf, but the average is 6·2. In addition to the trees already mentioned, the more mature larvae feed occasionally on *Salix* and *Quercus rubra.*

C. salmani does not appear to be attacked by many natural enemies, but a high rate of mortality occurs among the hibernating larvae. Nymphs of *Trombidium* sp. were found feeding on the eggs. The Ichneumonids, *Hemiteles tenellus*, Say, and *Pimpla* (*Itoplectis*) *conquisitor*, Say, and a Braconid, *Orgilus* sp., were reared from the pupae, but their status was not determined; the first two may be hyperparasites.

HOWARD (L. O.). *Aphelinus mali* **and its Travels.**—*Ann. Ent. Soc. Amer.*, xxii, no. 3, pp. 341–368. Columbus, Ohio, September 1929.

The introduction and progress in various parts of the world of *Aphelinus mali*, Hald., the North American parasite of *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm., are reviewed from the literature.

ANDREWS (E. A.). **The Mound-building Ant,** *Formica exsectoides* **F., associated with Tree-hoppers.**—*Ann. Ent. Soc. Amer.*, xxii, no. 3, pp. 369–391, 5 figs., 17 refs. Columbus, Ohio, September 1929.

A detailed account is given of the association of *Formica exsectoides*, Forel, with the Membracids, *Vanduzea arquata*, Say, and *Thelia bimaculata*, F., on *Robinia pseudacacia* in Maryland.

FROST (S. W.) & DIETRICH (H.). **Coleoptera taken from Bait-traps.**—*Ann. Ent. Soc. Amer.*, xxii, no. 3, pp. 427–437, 5 refs. Columbus, Ohio, September 1929.

In the course of studies of baits for the control of *Cydia molesta*, Busck, carried out in Pennsylvania from 1926 to 1928 [*R.A.E.*, A, xvii, 372, etc.], 188 genera and 258 species of Coleoptera, representing 40 families, were taken in the bait pails. Notes are given on each family represented, and some of the rarer species are mentioned. The most satisfactory bait for general purposes was found to consist of 1 part molasses to 20 parts water. The operation of the baits may be divided into three distinct periods : a short period of alcoholic fermentation lasting 1 or 2 days in warm weather ; a period of acetic fermentation lasting 3 or 4 weeks ; and a period of putrefaction during which the bait loses its attractiveness for most insects. During the first period and the early part of the second, Nitidulids and some Lamellicorns which naturally visit flowers came freely to the baits, whereas Silphids and certain Lamellicorns were attracted during the third period. The abundance of some species indicates that they are attracted to the bait, while the great variety of genera and small number of individuals among families such as the Chrysomelids indicate that these fell into the trap by accident.

GRISWOLD (G. H.). **On the Bionomics of a Primary Parasite and of two Hyperparasites of the Geranium Aphid.**—*Ann. Ent. Soc. Amer.*, xxii, no. 3, pp. 438–452, 3 pls., 3 figs., 10 refs. Columbus, Ohio, September 1929.

Studies on *Aphelinus jucundus*, Gahan, an internal primary parasite of *Macrosiphum cornelli*, Patch, and *Aphidencyrtus inquisitor*, How., an internal parasite of this Eulophid, have been carried out since 1925 in New York, both parasites having been reared continuously in cages since November 1926. Observations covering a much shorter period on *Asaphes americana*, Gir., showed this Pteromalid to be an external parasite of either *Aphelinus* or *Aphidencyrtus*. Unparasitised Aphids were never attacked by either of the hyperparasites. The technique of the breeding experiments is briefly outlined, and the immature stages of each parasite are described.

The following is taken from the author's summary : The immature stages of all three parasites are spent within the Aphid. The adults

emerge through a hole gnawed in the body wall of the dead Aphid, usually on the dorsal surface between the cornicles. Feeding at oviposition punctures is common in *Aphelinus* and *Aphidencyrtus*, but not in *Asaphes*. *Aphelinus* appears to reproduce by parthenogenesis only, all of the progeny being females. The two hyperparasites reproduce both sexually and parthenogenetically; in both species unmated females only produce males, and even with sexual reproduction males are more common. The life-cycle of *Aphelinus jucundus* requires 4 weeks and that of the Aphid 10 days, the lack of adjustment of the parasite to the host making it difficult to determine the percentage of parasitism. The two hyperparasites have life-cycles of about 3 weeks.

BREAKEY (E. P.). **Notes on the Natural Enemies of the Iris Borer,** *Macronoctua onusta* **Grote (Lepidoptera).**—*Ann. Ent. Soc. Amer.*, xxii, no. 3, pp. 459–464, 9 refs. Columbus, Ohio, September 1929.

In the course of observations of an unusually heavy infestation of iris in Wisconsin by *Macronoctua onusta*, Grote, which has lasted for several years, the following Diptera were bred from the larvae: *Muscina stabulans*, Fall., *M. assimilis*, Fall., *Myospila meditabunda*, F., *Sarcophaga cimbicis*, Tns., *S. latisterna*, Park., and *Lydella* (*Masicera*) *senilis*, Mg. In 1928 the degree of parasitism by Diptera was 10 per cent., the adult parasites appearing from 1st to 10th September and the first moth emerging on the latter date. The most numerous species was *M. stabulans*, followed by *L. senilis*. The host had apparently been destroyed in each instance just before pupation.

The leaf-feeding activities of the larvae of *M. onusta* are conducive to parasitisation by *L. senilis*, the eggs of which are laid on the leaves, and the accumulation of excrement in their burrows would help to enable larvae with habits such as those of *M. stabulans* to reach them. No Hymenopterous parasites emerged from the caterpillars under observation, though two species have been recorded in Indiana [*R.A.E.*, A, xvii, 39]. Predatory enemies include a bird, *Planesticus migratorius*, and small rodents. *Calosoma* spp., particularly *C. calidum*, F., were common in the field, and the larvae readily attacked those of *Macronoctua* in captivity.

NEISWANDER (C. R.) & HUBER (L. L.). **Height and Silking as Factors influencing European Corn Borer Population.**—*Ann. Ent. Soc. Amer.*, xxii, no. 3, pp. 527–542, 6 graphs, 2 refs. Columbus, Ohio, September 1929.

This paper is a more detailed account of part of a study of the European corn borer [*Pyrausta nubilalis*, Hb.] and its environment in Ohio [*R.A.E.*, A, xviii, 38]. From observations carried out in 1927 and 1928 on several varieties of maize, it appears that borer population is fundamentally the result of either the number of eggs deposited, or the rate of larval establishment, or both, and that the height and date of silking of maize are closely correlated with these, *P. nubilalis* being single-brooded in Ohio. In each year it was found that the greater the average height of maize in the plot, the more eggs were deposited. There is, however, no marked tendency for the moths to select larger individual plants in a given plot. The correlation between

oviposition and silking is almost as close as between oviposition and height, but this is to be expected since the correlation between silking and height is also close.

Studies to determine why delay in maturity as indicated by silking should reduce the survival rate in the larvae of *P. nubilalis* indicated that the greatest difference in mortality occurred at the time when the larvae were becoming established on the plant or were starting to feed. Data secured during 1928 showed that by the end of the period 16th–31st July mortality already amounted to 70 per cent. in an early variety of maize and 79 per cent. in two late ones, whereas the total mortality for the season was 79 and 88 per cent. From 23rd to 25th July, 45 per cent. of the larvae on the early variety were feeding on or among the tassels, whereas only 8 per cent. of those on one of the later ones were in this position, a correspondingly large proportion being among the rolled leaves of the plant. A week later 5·6 per cent. of the larvae were in the tassel in the early variety, as compared with 12·4 per cent. in the later one, and the early had 28 per cent. within the plant stem and the late only 5 per cent.

Resistance to larval survival varies inversely with the silking date whether this is due to variety, planting date, or rate of development. The difference in place of feeding is correlated with the fact that in the first variety the tassels appear earlier than in the second, and also open up sooner, forcing the borers to enter the stem at an earlier date. As the mortality for the remaining larval period was practically equal for both varieties, it is assumed that the specific difference in the development of the varieties was responsible for the difference in the survival rates. It seems that the early-tasselling food-plants are more perfectly timed to the early larval growth and accordingly larger percentages of larvae are able to become established in them.

DIBBLE (C. B.) & MARSTON (A. R.). **Low Cutting reduces Corn Borer Menace.**—*Quart. Bull. Michigan Agric. Expt. Sta.*, xii, no. 1, pp. 3–5, 2 figs. East Lansing, Mich., August 1929.

Three years' experimental work in maize fields in Michigan has shown that the numbers of the European corn borer [*Pyrausta nubilalis*, Hb.] left in the stubble can be greatly reduced by cutting the maize as low as possible. Ordinary binders can be set to cut much lower than 15 ins., which is the height of stubble frequently left, and special ones can be made that will cut almost to the surface of the ground. A table of results shows 371 borers to the acre left in 2·9-inch stubble as compared with 1,620 in 15-inch stubble. Borers in such short stubble, as well as those below the ground surface, can be destroyed by clean ploughing.

SWINGLE (H. S.). **Composition of Commercial Acid Lead Arsenate and its Relation to arsenical Injury.**—*J. Agric. Res.*, xxxix, no. 6, pp. 393–401, 10 refs. Washington, D.C., 15th September 1929.

The analysis of a large number of samples of acid lead arsenate over a period of years has shown that the content of water-soluble arsenic ranges from 0·04 to 5·93 per cent. as arsenic pentoxide. Moreover, there is always a varying quantity of arsenious oxide present (generally from 0·16 to 1·40 per cent.). The author has investigated the effect of these variations in composition on foliage injury, and shows the

results of field and laboratory experiments in a series of tables. The conclusions reached are as follows : At low concentrations of equivalent arsenic content, arsenious and arsenic acids are equally toxic to peach foliage. At higher concentrations arsenic acid is the more toxic. Arsenic acts as a cumulative poison within peach leaves. The minimum concentration of arsenic acid toxic to peach foliage contains the equivalent of 0·0012 per cent. of arsenic pentoxide. Acid lead arsenates containing less than 0·25 per cent. of arsenic pentoxide in water-soluble form gave minimum foliage injury. Nothing of practical importance was gained by further reductions in soluble arsenic. It is apparently impossible to reduce the soluble arsenic in acid lead arsenate sufficiently to prevent serious injury when used upon tender foliage. It is therefore evident that acid lead arsenate cannot be safely used upon susceptible plants without the addition of some material to prevent scorching. The initial soluble arsenic, within ordinary limits, has little or no effect upon the toxicity of acid lead arsenate to insects.

Brock (A. A.). **Orange County Insectary completes big Production Year.**—*Mon. Bull. California Dept. Agric.*, xviii, no. 9, pp. 515–516. Sacramento, Cal., September 1929.

The production of natural enemies of the citrophilus mealybug [*Pseudococcus gahani*, Green] in the Orange County Insectary of California has been the largest since its establishment. A total of 23,692,440 of *Cryptolaemus* [*montrouzieri*, Muls.] was produced during the year, of which 14,000,0000 were liberated after 1st January, these being considered adequate to deal with over 20,000 acres of *Citrus*. The total area infested with the mealybug is estimated at 45,000 acres. The number of the Coccinellids surviving the winter was not large, and heavy infestations appeared in the spring. Of the natural enemies introduced from Australia [*cf.* *R.A.E.*, A, xvii, 72, etc.], the numbers reared and liberated from the insectary included about 11,000,000 of the parasites, *Coccophagus gurneyi*, Comp., and *Tetracnemus pretiosus*, Timb., some 3,000,000 of the Dipterous predator, *Diplosis*, a few of the small Coccinellid, *Scymnus* (*Pullus*), and a few of *Chrysopa* sp. In localities where the Argentine ant [*Iridomyrmex humilis*, Mayr] is numerous, a poison campaign should be carried out immediately after the failure of the natural food supply owing to the control of the mealybug by natural or artificial means, small containers filled with a weak arsenical poison being placed in the path of the ants. Care should be taken not to allow the poison to come into contact with the bark of the trees or injury will result.

Flanders (S. E.). **A new Codling Moth Parasite.**—*Pan-Pacific Ent.*, vi, no. 1, p. 32. San Francisco, Cal., July 1929.

An undescribed Ichneumonid of the genus *Calliephialtes* has been observed parasitising the larvae of the codling moth [*Cydia pomonella*, L.] in walnuts in California. Of 50 immature larvae taken from walnuts collected at random from one orchard on 1st September, 15 were parasitised, the female having oviposited on them through the green tissue of the husk.

Timberlake (P. H.). **A new Species of the Encyrtid Genus** *Metaphycus* **from Washington (Hymenoptera).**—*Pan-Pacific Ent.*, vi, no. 1, pp. 43–45. San Francisco, Cal., July 1929.

The Encyrtid, *Metaphycus kincaidi*, sp. n., described from *Lecanium* (*Eulecanium*) *coryli*, L., at Seattle (Washington), appears to have almost exterminated the scale in the neighbourhood.

[Mote (D. C.).] **Department of Entomology.**—*Bienn. Rep. Oregon Agric. Expt. Sta. 1926–28*, pp. 101–109. Corvallis, Ore., 1928.

Entomological investigations conducted in Oregon during 1926–28 are briefly discussed. Besides the root weevils already recorded [*R.A.E.*, A, xvi, 23, 24], another species, *Dyslobus decoratus*, Lec., has been observed causing severe damage to strawberries.

In tests against *Hylemyia antiqua*, Mg., on onions, though numbers of flies and larvae were destroyed by means of fly traps and trap crops, no appreciable reduction in injury resulted. The yield of the crop was considerably increased by the application of mercury bichloride, 1 : 1,000, once a week for 5 weeks, beginning when the plants were 1 in. high, but the method is expensive. Severe damage to gooseberries was caused by *Xylocrius agassizi*, Lec. (black gooseberry borer). Promising results were obtained with paradichlorobenzene, applied against the larvae in August at the rate of 1 oz. to each plant. Serious injury to cherries, the first for several years, was caused in one locality by *Syneta albida*, Lec. [*cf.* xiii, 626] in 1925 and 1926; during the latter year damage in some orchards amounted to 70 per cent. of the fruit. A spray of 4 lb. lead arsenate to 100 U.S. gals. water, thoroughly applied just before and just after blossoming, gave 70 per cent. control. Experiments against *Taeniothrips inconsequens*, Uzel, which has caused serious damage to prunes in recent years, showed that spraying early in the season will ensure an average set of fruit.

In 1926 various oil sprays tested in summer against the codling moth [*Cydia pomonella*, L.] gave no appreciable results and caused severe injury to the apples. In 1927 infestation of apples treated with three types of oil ranged from 18 to 25 per cent., as compared with 4 per cent. of those treated with lead arsenate. In the laboratory the oils destroyed a very high percentage of the eggs. Eggs deposited on sprayed fruit hatched as readily as those on unsprayed fruit, but the moths showed a preference for ovipositing on the latter. Of other sprays used, calcium arsenate, 2 lb. to 100 U.S. gals. water, was as effective as lead arsenate; 40 per cent. nicotine sulphate substituted for lead arsenate in the last cover spray gave slightly inferior results. Calcium or sodium fluosilicate dusts (15 per cent.) were ineffective. In experiments with lead arsenate sprays, using 2, 4 and 6 lb. to 100 U.S. gals. water, it was found that a higher percentage of uninjured fruit was obtained with 4 lb., 6 lb. being no more effective. Slightly better control resulted where casein-lime spreader was added to the spray. Tests with arsenical dusts showed that under favourable weather conditions dusting may be as satisfactory as spraying.

Experiments with soil fumigants, poison baits, etc., against *Scutigerella immaculata*, Newp. (garden centipede) gave inconclusive results. The eggs of this Symphilid, which are described, were found in the field from 22nd April to 2nd June; the egg stage lasted on an average

20 days. The first young individuals were found on 2nd May and appeared to be fully grown by August. Some overwintered Symphilids lived in the laboratory until 1st September.

FERRIS (G. F.). **Concerning the Mediterranean Fruit Fly.**—*Science*, lxx, no. 1819, pp. 451–453. New York, N.Y., 8th November 1929.

The author doubts whether any quarantines or other measures will prevent any insect, such as the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], from being introduced into the United States, or whether its eradication, once it has gained entry, is economically possible. In his opinion the whole question of plant quarantines, from the biological, economic and legal points of view, requires reconsideration.

Record of current Work, January 1 to March 31, 1929.—*U.S. Dept. Agric., P.Q.C.A.*, S.R.A. no. 98, pp. 1–8. Washington, D.C., September 1929.

A table is given showing the rapidity of the spread in the United States of the Japanese beetle [*Popillia japonica*, Newm.] from 1916 to 1928. *Anomala orientalis*, Waterh. (Asiatic beetle) appears likely to become a very serious pest of lawns, but extends its distribution very slowly, unless carried mechanically. *Aserica castanea*, Arrow, also attacks lawns, and in addition, the adults are capable of causing serious injury to foliage.

No fresh infestations by the pink bollworm [*Platyedra gossypiella*, Saund.] are recorded. The thurberia weevil [*Anthonomus grandis thurberiae*, Pierce] was more numerous on cotton in 1928 in all parts of the Santa Cruz Valley in Arizona south of Tucson than in previous years, the heaviest infestation occurring in the southern end of the valley.

There was no sign of the gipsy moth [*Porthetria dispar*, L.] in New Jersey in 1928, but in the barrier zone of western New England and eastern New York a number of fresh infestations have been found in western Massachusetts and north-western Connecticut. Attention was directed to the possibility of spreading the satin moth [*Stilpnotia salicis*, L.] by means of pussy-willow twigs sent from western Washington to the eastern States. A close approach to completion of the campaign for the elimination of summer host-fruit trees is the most important development in the area regulated on account of the Mexican fruit-fly [*Anastrepha ludens*, Lw.] in Texas in January–March 1929, over 36,000 peaches, plums, guavas and similar trees having been destroyed since 1927 [*cf. R.A.E.*, A, xviii, 66]. No larvae were found in the regulated area during this period, although they continue to occur occasionally in the markets of Matamoros, just over the Mexican border.

Quarantine on account of Japanese Beetle. Notice of Quarantine no. 48 (Sixth Revision). Rules and Regulations (Seventh Revision) supplemental to Notice of Quarantine no. 48.—*U.S. Dept. Agric., P.Q.C.A.*, S.R.A. no. 98, pp. 30–37. Washington, D.C., September 1929.

The previous revision of Quarantine no. 48 and of the Rules and Regulations [*R.A.E.*, A, xv, 297] are superseded as from 15th February

1929. The area quarantined on account of *Popillia japonica*, Newm., is revised to include infested areas in Maryland and new areas in the previously infested States of Connecticut, Delaware and Pennsylvania. Less stringent regulations are applied to lightly infested areas in the District of Columbia and Virginia.

SMITH (L. B.). **The Japanese Beetle, present Status and Control.**—*Yearb. Acad. Nat. Sci. Philadelphia, 1928,* pp. 5–15, 3 pls. Philadelphia, 1929.

This is a review of the situation regarding *Popillia japonica*, Newm., in the United States, including the quarantine and biological and other measures directed against it. In the author's opinion the outlook for the ultimate biological control of the insect is most hopeful.

[**Orchard Pests and their Control in Ontario.**]—*60th Ann. Rep. Fruit Gr. Ass. Ontario, 1928,* pp. 29–43. Toronto, 1929.

The situation with regard to the oriental peach moth [*Cydia molesta*, Busck] in Ontario is reviewed by W. A. Ross, who also discusses the uses and limitations of oil sprays. He does not consider that it pays to use oil in the vast majority of apple orchards, where Coccids, the fruit-tree leaf-roller [*Tortrix argyrospila*, Wlk.] and the European red mite [*Paratetranychus pilosus*, C. & F.] are not serious pests; pear orchards, on the other hand, should be sprayed annually with a 3 per cent. oil spray in late March or April to control the pear psylla [*Psylla pyricola*, Först.]. The same spray should be used on sweet cherry just before bursting of the buds against the black cherry aphis [*Myzus cerasi*, F.]. On peaches it is applied in Bordeaux mixture, but should only be employed if the San José scale [*Aspidiotus perniciosus*, Comst.] is present, or (at 4 per cent. strength) if the cottony peach scale [*Pulvinaria amygdali*, Ckll.] occurs.

Notes are given by L. Caesar on the life-history and control of *T. argyrospila*, against which arsenicals are effective in a light infestation, though in severe cases a 7 or 8 per cent. lubricating oil emulsion should be used against the eggs, and on the apple maggot [*Rhagoletis pomonella*, Walsh] and the cherry fruit-flies [*R. cingulata*, Lw., and *R. fausta*, O.S.], the adults of which can be controlled by sprays of 1½ lb. lead arsenate to 40 gals. water.

THOMPSON (W. R.). **On Natural Control.**—*Parasitology*, xxi, no. 3, pp. 269–281. Cambridge, 30th September 1929.

The author defines natural control as the check exerted on the multiplication of organisms by natural, as opposed to artificial, environmental factors. He considers that the idea that the distribution of an organism is chiefly determined by one or two limiting factors is incorrect. The reduction of reproductive rate preventing an increase or determining a decrease in numbers is due in the vast majority of cases to complex combinations of factors, of which different members predominate in different times and places. That the natural control of organisms can be effected by agencies of different kinds depends on the fact that it is primarily due, not to any complex universal mechanisms or regulatory factors, but rather to the intrinsic limitations of the organisms themselves. Every organism has certain

specific characteristics, and an environment that meets its specific needs is, for a given species, the optimum environment. Given this environment, indefinite increase at a specific rate is possible ; but the environmental conditions are in no two places exactly alike, and at a given moment, in a given area, the precise environmental complex constituting the optimum for a given species will be found at relatively few points. When conditions approach the optimum, the species automatically increases in numbers. This increase constitutes what is called, technically, an outbreak, which is of necessity an abnormal phenomenon. The organism, however, obviously cannot go on increasing indefinitely. As it increases in numbers, it necessarily spreads, both in space and time. As it spreads, it moves to points outside its optimum environment, when its rate of multiplication immediately diminishes. Thus, even under most favourable conditions, there cannot be a continuous and uninterrupted increase in numbers, but simply an oscillating movement, which is more likely to be feeble than extensive, because of the narrowly circumscribed optimum and restrictive adaptive powers of the majority of species.

The author believes that the control of insect pests is principally effected by physico-chemical factors, rather than by entomophagous insects. The reason for this is that parasitic control is effected by their specific organisms, whose distribution in time and space is limited by their specific requirements, of which the presence of the host is only one. Only a few of such organisms are capable of acting upon any given host. The physical factors of control, on the contrary, are simply intensities of omnipresent physical and chemical influences above or below the limits between which a given species can subsist. The range over which they will be found acting is obviously far more extensive than that of the biotic factors. Furthermore, the number of physical factors of control is, for practical purposes, unlimited, since any departure in either the positive or negative direction of any physical factor, from the intensity that a given species can tolerate, will eliminate it. In general, it appears that such tropical regions as are favourable to life in general will be those in which the biological factors will be of the greatest importance as compared with physical ones, and that in regions unfavourable to life in general they will be relatively unimportant. The part played by biological and physical factors respectively, in the control of any organism in a region, can, however, be determined only by careful investigation, since these general rules are not always applicable. The most promising method for attacking the problem of the natural control of a given species is to determine the ecological optimum, by a careful laboratory study of its physiology and habits. The organism with its specific behaviour and requirements is the centre of the problem, and it is not until this is understood that a clue will be found to the fluctuations in its numbers.

PAUL (W. R. C.). **The Control of Red Weevil** (*Rhyncophorus ferrugineus* **F.**) **in Coconut Palms.**—*Trop. Agriculturist*, lxxiii, no. 3, pp. 131–135, 1 pl. Peradeniya, September 1929.

Rhynchophorus ferrugineus, F. (red weevil) is the most important pest of coconuts in Ceylon. The stems of young trees 4–10 years old are usually attacked ; those of mature palms being too hard to permit the penetration and development of the larvae. The crowns of trees of all ages may be attacked when they have been damaged

by *Oryctes rhinoceros*, L., or other causes, and wounds or cracks on the stems of young palms also attract the ovipositing weevils [*R.A.E.*, A, xi, 56]. The larvae on hatching tunnel through the soft tissues of the stem, where the life-cycle is completed. The weevils have been observed to attack other species of palm, including *Caryota urens*.

To prevent infestation, wounding the trees and stripping the leaves should be avoided. Wild pigs and porcupines, which damage the basal parts of young palms, should be kept in check. Heavy nitrogenous manuring promotes rapid and sappy growth, which causes cracks in the bark. Attacked palms should be treated without delay. The infested tissues should be cut out and the cavity painted with tar, filled in with sand and cement mortar and finally cemented over flush with the surface of the stem ; rubble or small stones should be substituted for sand when the cavity is large. Since the weevils are attracted to recently killed palms and breed in them for about 3 months, their use as traps is recommended. *C. urens* forms a very attractive trap, as most of its stem at any age is soft enough to permit the development of the larvae. Young coconut palms that have fallen or the apical parts of recently dead ones of any age to a distance of two or three feet from the crown can also be used. The stems should be split longitudinally into two pieces, which should be piled up. Within the first two weeks a number of ovipositing weevils can be captured round the traps ; at the end of two months the pieces should be split open and the insects collected and destroyed. In one locality two traps were found to contain 77 and 60 adults and 669 and 737 larvae respectively.

MILLER (N. C. E.). **Notes on *Setora nitens* Walk., a " Nettle Caterpillar " Pest of Coconut Palms, with special Reference to Outbreaks in the Teluk Anson and Bagan Datoh Districts.**—*Malayan Agric. J.*, xvii, no. 9, pp. 315–325, 1 pl., 16 refs. Kuala Lumpur, September 1929.

The Limacodid, *Setora nitens*, Wlk., has been known in Lower Perak since 1912, but its attacks are becoming more frequent and widespread and have extended from young to mature palms. About 2,500 acres are affected in various districts, the food-plants being coconut, oil palm (*Elaeis guineënsis*) and *Nipa fruticans*. In Java and Sumatra the range of food-plants is much wider. The eggs are usually deposited in small, irregular patches on the lower surface of a pinna near the tip, and the larvae prefer to remain under the pinnae, especially of the lower fronds, where they are protected from sun and rain, until all but the midrib is eaten away. When mature, they drop to the ground and construct cocoons in cracks in the soil, among roots of cover crops, or in fibres at the base of fronds. The pupal stage lasts 25–27 days, and the whole life-cycle seems to require about 6–7 weeks. On palms up to 6 years old hand-picking the larvae is very effective ; very young larvae can be squashed on the trees, the hands being protected from the urticating hairs, and larger ones can be dislodged from the trees with a stick and buried in the soil. On mature palms, long bamboo poles with a brush attached are useful. Cocoons may be collected. A spray of 2 or 3 lb. lead arsenate to 50 gals. water is effective, but requires expert supervision and a powerful sprayer for larger trees.

The larvae are attacked by several parasites, notably the Tachinid, *Chaetexorista javana*, Br. & Berg., which has proved of considerable value in controlling outbreaks of this moth on tea in Java. The fly

oviposits on larvae of any stage, and the parasite larva feeds internally on the host. The latter usually lives to spin its cocoon, in which the parasite pupates. Collected cocoons should therefore be kept in such a manner that the adult parasites can escape. Insectivorous birds should be encouraged, as they are of value in Java ; field rats and ants destroy the cocoons, and fungous diseases kill many of the larvae.

REYNE (A.). **Over een hevige schildluisplaag in de cocospalmen op het eiland Groot-Sangihe.** [On a severe Scale Infestation of Coconut Palms in the Island of Great Sangi.]—*Vakbl. Biol.*, x, no. 8, pp. 129–134. Helder, April 1929.

An outbreak of *Aspidiotus destructor*, Sign., on coconuts, which was more severe than any previously observed in the Dutch East Indies, began in October 1925 on the island of Great Sangi, and by the end of 1927 about 350,000 palms were attacked, many thousands being killed. Two parasites of this Coccid, *Comperiella* [*unifasciata*, Ishii, and *Aphelinus chrysomphali*, Mercet], were introduced from Java and the former appears likely to become generally established. At the end of 1927 and early in 1928 there was a great mortality among the scales in the district where the outbreak was first observed, but not in localities that were infested later. A change in the character of the sap of the infested palms was noticed, and this may have been the cause of the death of the Coccids.

HARRISON (E.). **History and Activity of Locusts in Kenya and relative Costs of Destruction.**—*Bull. Dept. Agric. Kenya*, no. 9 of 1929, 26 pp. Nairobi, 1929.

Invasions of locusts (*Schistocerca gregaria*, Forsk.) have been recorded in Kenya Colony in 1892, 1894 and 1898. From 1901 to 1909 and 1914 to 1917 locust swarms came every year ; they were recorded in 1919, but were not observed again until March 1928, when the present invasion started. Three-quarters of the land surface of the Colony, which are scarcely populated, are ideal places for locust propagation, and control measures are bound to be expensive and incomplete until the territory is further developed. For the time being most of the uninhabited areas can be reached only by aeroplanes ; it is hoped that it may eventually become possible to use these to scout and drop poison bait or sodium arsenite dust.

The author, however, maintains that relatively inexpensive measures of destruction should be used wherever possible. As the result of his experience during the present invasion, he suggests a scheme of locust control organisation, with central headquarters situated in Nairobi and district field headquarters with eight operating units, each consisting of a temporary locust officer and native staff. A detailed estimate for such an organisation is included ; the total cost of the upkeep of one field headquarters and units during 40 days, which are necessary to exterminate an infestation of 5–6 thousand acres of actual hoppers, would be about £3,800.

Against the flying swarms, flame-throwers, sprays, dusts, and baits may be used, but the results obtained do not usually justify the cost. Against hoppers, baits and contact spraying or dusting with sodium

arsenite are suggested. For spraying, 5 oz. sodium arsenite is dissolved in 4 gals. water; the cost is about 19*s.* an acre with hand pumps, and 6*s.* with a pump used direct from a lorry. Dusts should be applied with tins converted into fine dredges. Bran, dung, chopped potato tops, sisal waste or chenopodiaceous weeds can be used for the baits, with or without an admixture of 10 per cent. of fresh crushed hoppers. Sodium arsenite is added at the rate of 20 oz. to 100 lb. dry bait, with as much water as is necessary to damp the bait evenly. Fairly moist bait is flung out among aggregates of hoppers in the evenings and mornings; during the day this should be done only when they are feeding. Egg destruction may be effected by hoeing over the infested land.

BALACHOWSKY (A.). **Observations biologiques sur les parasites des coccides du Nord-Africain. (Contribution à l'étude des coccides de l'Afrique mineure; 5e note.)**—*Ann. Epiphyties*, xiv (1928), no. 4, pp. 280–312, 18 figs., 27 refs. Paris, July 1929.

Continuing his studies of north African Coccids [*R.A.E.*, A, xvii, 128], the author reviews the parasites and predators found in association with them and indicates their distribution in north Africa.

The Nitidulids, *Cybocephalus seminulum*, Baudi, and *C. flaviceps*, Reitt., are predacious on *Parlatoria blanchardi*, Targ. (date scale) and, together with the Coccinellid, *Pharoscymnus anchorago*, Fairm., reduce it to negligible importance in many regions. An outbreak of *P. blanchardi* suddenly appeared in south Oran in 1920, some 100,000 date palms being killed. In June 1925, *C. seminulum* and *P. anchorago* were introduced, and although the scale is still present to some extent, no more dying trees are seen. *C. seminulum* has several generations a year; the adults are strong fliers and are carried long distances by the wind. *C. flaviceps* has also been found attacking *Diaspis zamiae*, Morg., and *Chrysomphalus dictyospermi*, Morg.

Coccinellid predators include *Thea thuriferae*, Sic., attacking *Phenacoccus peyerimhoffi*, Vayss.; *Chilocorus bipustulatus*, L., attacking *Aspidiotus hederae*, Vall., and other Coccids; *Exochomus quadripustulatus* var. *anchorifer*, All., which is a general feeder on Coccids; *E. pubescens*, Kust., which is usually predacious on Aphids, but was found once attacking eggs and young larvae of *Gueriniella serratulae*, F; *Novius cardinalis*, Muls., which is perfectly acclimatised in Algeria and apparently only feeds on *Icerya purchasi*, Mask.; *N. cruentatus*, Muls., found rarely and probably predacious on *Palaeococcus* (*Monophlebus*) *fuscipennis*, Burm.; *Hyperaspis guttulatus*, Fairm., exclusively predacious on *Stotzia striata*, Marchal; *Scymnus kiesenwetteri*, Muls., attacking *Trabutina elastica*, Marchal, and an undescribed species of *Naiococcus*; *Pharoscymnus setulosus*, Chevr., predacious on *Aspidiotus hederae*, and *Chionaspis striata*, Newst.; and *P. anchorago*, which attacks *Phoenicococcus marlatti*, Ckll., and *Parlatoria blanchardi*. *Cryptolaemus montrouzieri*, Muls., has been introduced into Algeria on more than one occasion, but seems unable to withstand the north African winter.

Many of the Hymenopterous parasites of Coccids have not yet been observed in north Africa; but the following Eulophids have been recorded: *Aphelinus chrysomphali*, Mercet, which is practically exclusively parasitic on *Chrysomphalus dictyospermi*, but is occasionally found on *C. ficus*, Ashm. (*aonidum*, auct.); *Aphelinus longiclavae*,

Mercet, found in small numbers on *Aspidiotus hederae, C. dictyospermi, Diaspis zamiae*, and *Chionaspis berlesei*, Leon.; *Aphelinus diaspidis*, How., on *Diaspis echinocacti*, Bch. (*calyptroïdes*, Costa); *A. maculicornis*, Masi, on *Parlatoria pergandei*, Comst., of which it reduces the numbers considerably throughout the summer; *A. mytilaspidis*, LeB., on *Lepidosaphes ulmi*, L.; *Aspidiotiphagus citrinus*, Craw, on *Aspidiotus hederae* and other Coccids; *Aspidiotiphagus lounsburyi*, Berl. & Paoli, found in small numbers attacking *Fiorinia fioriniae*, Targ., and *Chrysomphalus ficus*; *Prospaltella leucaspidis*, Mercet, parasitic on *Leucaspis pusilla*, Lw.; *Prospaltella* sp., on *Chionaspis ceratoniae*, Marchal; *Hispaniella lauri*, Mercet, on *F. fioriniae*; *Coccophagus scutellaris*, Dalm., on *Pulvinaria vitis*, L.; *C. lunulatus*, How., on *Coccus hesperidum*, L., and *P. mesembryanthemi*, Vallot; *C. niger*, Masi, on *Stotzia striata*; and *Tetrastichus* sp., on *Asterolecanium ilicicola*, Targ.

Encyrtids include *Encyrtus lunatus*, Dalm., parasitic on *Filippia oleae*, Costa; *Chiloneurus formosus*, Boh., and *Blastothrix ilicicola*, Mercet, on *Lecanium* (*Sphaerolecanium*) *emerici*, Planchon; *Chiloneurinus microphagus*, Mayr, which is of great value in reducing the numbers of *Lepidosaphes ulmi*; *Metaphycus hirtipennis*, Mercet, parasitic on *Kermes* (*Kermococcus*) *vermilio*, Planchon; *Habrolepis dalmani*, Westw., on *Asterolecanium ilicicola*; *Aphycus* sp., on *Chionaspis berlesei*; *A.* (*Euaphycus*) *asterolecanii*, Mercet, on *A. ilicicola*; *Anthemus* sp., on *Lepidosaphes ampelodesmae*, Newst.; *Trichomastus* sp., on *Lecaniodiaspis sardoa*, Targ.; and *Signiphora merceti*, Malen., on *Aspidiotus rapax*, Comst. (*Hemiberlesia camelliae*, Sign.). The Mymarids, *Dicopus citri*, Mercet, and *Alaptus aurantii*, Mercet, have been reared from *F. fioriniae*. The Pteromalids, *Enargopelte nigra*, Mercet, and *Scutellista cyanea*, Mots., have two generations a year. The former is parasitic on *L. sardoa*, and the latter attacks Lecaniines exclusively and preferably *Saissetia oleae*, Bern., *S. coffeae*, Wlk. (*hemisphaerica*, Targ.) and *Ceroplastes rusci*, L. Another Pteromalid, *Pachyneuron* sp., was obtained from a rearing of *Naiococcus* sp., but may be a parasite of the larvae of the Coccinellid, *Scymnus kiesenwetteri*, which are predacious on this Coccid. Noctuid predators include *Eublemma* (*Erastria*) *scitula*, Ramb., which attacks various Coccids, and *Eublemma deserta*, Stgr., and *E. virginalis*, Obth., which feed on *Margarodes* spp. The Agromyzid, *Cryptochaetum grandicorne*, Rond., is an endophagous parasite of *Gueriniella serratulae*, and among Neuroptera, *Megalomus balachowskyi*, Lest., feeds on colonies of *Pseudococcus nipae*, Mask., and *Fontenella maroccana*, Lest., is predacious on *Orthezia arenariae*, Vayss.

de Lépiney (J.). **Les insectes nuisibles du chêne liège dans les forêts du Maroc (deuxième étude).**—*Ann. Epiphyties*, xiv (1928), no. 4, pp. 313–321, 1 fig. Paris, July 1929.

After many attempts, the Japanese egg-parasite, *Ooencyrtus* (*Schedius*) *kuwanae*, How., has been successfully introduced from the United States into Morocco, and an account is given of its rearing and acclimatisation for the biological control of *Porthetria* (*Lymantria*) *dispar*, L., on cork oak [*R.A.E.*, A, xvi, 314]. Even in the winter, two distinct generations of the parasite were reared in two months, and during the summer, reproduction was continuous, twenty days only being required for each generation. Its work is often facilitated by

that of *Trogoderma versicolor*, Creutz., which breaks up the egg-masses of the moth. One enemy of *O. kuwanae* has been discovered, a small jumping spider that devours the adults on the egg-masses.

Phalera bucephala var. *bucephalina*, Stdgr., has been observed only in one small forest of cork oak, defoliating the trees in September-October, and having apparently only one generation a year, though in the south of its range there are two. The larvae are much reduced in numbers by the Mantid, *Sphodromantis viridis*, Forsk. Minor Lepidopterous pests of the foliage are *Drymonia chaonia*, Hb., *Marumba quercus*, Schiff., *Carcina quercana*, F., *Gracilaria* (*Coriscium*) *sulphurella* var. *aurantiella*, Peyer, and *Boarmia manuelaria*, H.-S. (*illicaria*, Hb.), which is heavily parasitised by the Braconid, *Apanteles triangulator*, Wesm. *Anacridium* (*Orthacanthacris*) *aegyptium*, L., and *Chrysomphalus dictyospermi*, Morg., also attack the foliage. The Hemerobiid previously recorded as predacious on *Chaitophorus* sp. [xvi, 316] has been identified as *Chrysopa vulgaris*, Schm. The branches are infested by the Aphid, *Dryaphis* sp., and the Coccids, *Chionapis lepineyi*, Balach., and *Kermes vermilio*, Planchon, which is parasitised by the Encyrtid, *Eucomys scutellata*, Swed. The Scolytid, *Xyleborus monographus*, F., bores into the trunk.

[Konakov (N. N.).] **Конаков (Н. Н.). Ueber die Grenzen der Verbreitung von Maikäfern** (*Melolontha melolontha* **L. und** *M. hippocastani* **F.) im Zentral-Schwarzerdebodengebiete.** [On the Boundaries of the Distribution of Cockchafers (*M. melolontha* and *M. hippocastani*) in the Black Soil Zone of Central Russia (*In Russian*).]—*Trav. Inst. Rech. sci. Univ. Voronèje*, iii, pp. 106–110, 15 refs. Voronezh, 1929. (With a Summary in German.)

The distribution of *Melolontha melolontha*, L., and *M. hippocastani*, F., in Central Russia is discussed from the literature. The former species, which is called the western cockchafer, occurs in western Russia and the Ukraine, the eastern boundaries of its distribution running through the Pskov, Vitebsk, Smolensk, Kursk, and Kharkov Governments. *M. hippocastani*, called the eastern cockchafer, is abundant in the north of the Orel Government, and in the Tambov and Voronezh Governments. It does not occur in the south steppe districts (Novocherkask, Rostov-on-Don and Azov) or in the Caucasus.

[Kostenko (N.).] **Костенко (Н.).** *Anoxia pilosa* **Fabr. a Pest of Vines in the Lower Dnieper Sands.** [*In Russian.*]—*Vestn. Vinogr., Vinodel. Vinotorg. S.S.S.R.*, xxx (3rd Ser. i), no. 1, pp. 29–31, 1 fig., 6 refs. Odessa, October 1929.

In investigations in May 1929 on the occurrence of Lamellicorn beetles in vineyards in the Lower Dnieper sands, the larvae of *Anoxia pilosa*, F., were for the first time found in the soil, together with those of *Polyphylla fullo*, L., *Anisoplia segetum*, Hbst., *Anomala praticola*, F., and in one instance *Monotropus nordmanni*, Blanch. Larvae of *A. pilosa* averaged 1 or 2 to each 20 sq. ft.; they gradually decreased in numbers with an increase of the amount of sand covering the soil, no larvae being present in places where the sand was 10 ins. deep. This is surprising, as in the Ukraine *A. pilosa* breeds in the sands.

Papers noticed by Title only.

[Spesivtzev (P.).] Spessivtseff (P.). **Zur Morphologie der schwedischen *Pityophthorus*-Arten.** [The Morphology of Swedish Species of *Pityophthorus*.]—*Ent. Tidskr.*, 1, pt. 3–4, pp. 297–303, 3 figs. Stockholm, 1929.

Trägårdh (I.). **Om barkborrarnas gångsystem.** [The Gallery Systems of Bark-beetles.]—*Ent. Tidskr.*, 1, pt. 3–4, pp. 309–315. Stockholm, 1929.

Bondar (G.). **A broca do tomateiro** (*Phyrdenus divergens*, **Champ.**). [The Tomato Borer, *P. divergens*, Germ., in Brazil.]—*Bol. Minist. Agric. Ind. Comm.*, xviii (ii), no. 2, pp. 186–189, 3 figs. Rio de Janeiro, August 1929. [See *R.A.E.*, A, xvii, 45.]

Jaques (H. E.). **The Distribution of White Grubs** [*Lachnosterna*] **in Iowa in 1927.**—*Proc. Iowa Acad. Sci.*, xxxv, pp. 303–304, 1 map, 2 refs. Des Moines, 1928. [*Cf. R.A.E.*, A, xvii, 28.]

Common Names of Insects approved for general Use by American Economic Entomologists [three names].—*J. Econ. Ent.*, xxii, no. 5, p. 825. Geneva, N.Y., October 1929. [*Cf. R.A.E.*, A, xvii, 128.]

Allman (S. L.). **The Codling Moth** (*Cydia pomonella*, **L.**). **Control Experiments and Life History Observations at Bathurst, New South Wales, 1926-27.**—*Sci. Bull. Dept. Agric. N.S.W.*, no. 31, 36 pp., 11 figs., 3 refs. Sydney, March 1928. [See *R.A.E.*, A, xvi, 101.]

[Pantyukhov (P. V.).] **Пантюхов (П. В.). Instructions for the Use of Spraying Apparatus for Orchards.** [*In Ukrainian.*]—*Kharkiv. kr. sil.-gosp. dosvidna Stantz.*, Ent. Dept., no. 10, 15 pp., 8 figs., 6 refs. Kharkov, 1929.

Komarek (J.). **Die Bekämpfung der Nonne von Flugzeugen mittels Calcium-Arsenat.** [The Control of *Lymantria monacha*, L., by Aeroplane Dusting with Calcium Arsenate.]—*Cong. intern. Zool.*, x (1927), pt. 1, pp. 223–225. Budapest, 1929. [*Cf. R.A.E.*, A, xvii, 581.]

Schilder (F. A.). **Die Beziehung der Nahrung der Coccinelliden zur systematischen Stellung der einzelnen Genera.** [The Connection of the Food of Coccinellids with the Systematic Position of certain Genera.]—*Cong. intern. Zool.*, x (1927), pt. 2, pp. 1018–1021, 1 ref. Budapest, 1929.

Jakubski (A. W.). **Ueber Morphologie und Biologie der polnischen Cochenille** (*Margarodes polonicus*). [The Morphology and Biology of *M. polonicus*.]—*Cong. intern. Zool.*, x (1927), pt. 2, pp. 1076–1096. Budapest, 1929.

Thompson (W. R.). **The Natural Control of *Pyrausta nubilalis* Hb. in Europe.**—*Cong. intern. Zool.*, x (1927), pt. 2, pp. 1183–1195, 4 figs. Budapest, 1929. [*Cf. R.A.E.*, A, xvi, 528.]

Chapman (R. N.). **Biotic Potential, Environmental Resistance and Insect Abundance.**—*Cong. intern. Zool.*, x (1927), pt. 2, pp. 1209–1218, 1 graph. Budapest, 1929. [*Cf. R.A.E.*, A, xvi, 312.]

Vimmer (A.). **Muši parasiti Českých motýlu.** [A List of Diptera recorded in the Literature as Parasites of Lepidoptera in Czechoslovakia.]—*Čas. českoslov. Společn. ent.*, xxv, no. 3–4, pp. 48–52, 1 ref. Prague, October 1928. (With a Summary in German.)

Schmitz (H.). **Revision der Phoriden.**—Large Imp. 8vo, 211 pp., 49 figs., 2 pls., 7 pp. refs. Berlin & Bonn, Ferd. Dümmler, 1929.

Pomeyrol (R.). **La parthénogenèse des Thysanoptères. La maturation des oeufs parthénogénétiques chez l'** *Heliothrips haemorrhoidalis.* —*Bull. biol. Fr. Belg.*, lxii, pp. 1–20, 15 refs. Paris, 1928.

Speyer (W.). **Die Embryonalentwicklung und das Ausschlüpfen der Junglarven von** *Psylla mali* **Schm.** [The Embryonal Development and Hatching of the Young Larvae of *P. mali*.]—*Z. wiss. Insekt-Biol.*, xxiv, no. 7–8, pp. 215–220, 5 figs. Berlin, 1st October 1929.

China (W. E.). **A new Species of** *Bryocoropsis* [*cotterelli*, sp. n.] (**Hem. Capsid.**) **on Cacao in Fernando Póo.**—*Bull. Ent. Res.*, xx, pt. 3, pp. 253–254, 1 fig. London, October 1929.

Hall (W. J.). **Observations on the Coccidae of Southern Rhodesia.—II.** [16 Species and Varieties of Diaspinae including 9 new ones.] —*Bull. Ent. Res.*, xx, pt. 3, pp. 345–358, 9 figs. London, October 1929. [*Cf. R.A.E.*, A, xvii, 191.]

Bodenheimer (F. S.). **Beschreibung der mannaproduzierenden Insekten.** [Description of the Insects (Coccids and Jassids) producing Manna in Sinai.]—*Ergebnisse der Sinai-Expedition 1927*, pp. 64–79, 2 figs., 4 pls. Leipzig, 1929.

Bodenheimer (F. S.). **Die Coccidenfauna der Sinai-Halbinsel.** [The Coccid Fauna of the Sinai Peninsula (including one new Genus and six new Species).]—*Ergebnisse der Sinai-Expedition 1927*, pp. 104–117, 6 pls., 2 refs. Leipzig, 1929.

Takahashi (R.). **Ueber die Trophobiosen-Insekten** [Coccids] **von** *Cremastogaster rogenhoferi* **aus Formosa.** [*In Japanese.*]—*Dobuts. Z.* [*Zool. Mag.*], xli, no. 485, pp. 122–129, 2 figs. Tokyo, 1929. (Abstract in *Jap. J. Zool.*, ii, no. 4, p. (109). Tokyo, 30th November 1929.) [*Cf. R.A.E.*, A, xvii, 567.]

Takahashi (R.). **Notes on some Formosan Aphididae (3)** [including two new Species and one new Variety].—*Trans. Nat. Hist. Soc. Formosa*, xix, no. 105, pp. 525–532, 1 fig. Taihoku, Formosa, December 1929. [*Cf. R.A.E.*, A, xvii, 608.]

Gillette (C. P.) & Palmer (M. A.). **Five new Aphididae from Colorado.**—*Ann. Ent. Soc. Amer.*, xxii, no. 3, pp. 468–479, 2 pls., 2 refs. Columbus, Ohio, September 1929.

Knowlton (G. F.). **Aphid Notes from Utah.**—*Pan-Pacific Ent.*, vi, no. 1, pp. 33–42, 1 pl., 3 refs. San Francisco, Cal., July 1929.

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de Mello (F.). **Triconymphides de l'intestin de** *Leucotermes indicola* **Wasm. avec référence spéciale à la complexité de leurs phénomènes mitotiques.**—*Trans. 7th Cong. Far East. Ass. Trop. Med. 1927*, ii, pp. 582–598, 5 pls., 28 refs. Calcutta [1929].

[POLOZHENTZEV (P.).] **Положенцев (П.). Zur Biologie von** *Spondylis buprestoides* **L.** [*In Russian.*]—*Rev. russe Ent.*, xxiii, no. 1–2, pp. 48–59, 7 figs., 9 refs. Moscow, 1929. (With a Summary in German.)

A more detailed account [*cf. R.A.E.*, A, xiv, 339] is given of the bionomics of *Spondylis buprestoides*, L., as a result of observations from 1925 to 1927 in the Buzuluk pine forests of the Samara Government. The flight of the adults, which live 20–25 days, is delayed and less regular in cold and rainy weather. Trees that have been recently damaged by fire or freshly felled are particularly attractive. Adults in captivity did not feed. Eggs are deposited in batches of 2–5 along the bark of the roots, particularly of scorched pines, from near the trunk of the tree to a depth of about 8 ft. A female lays 100–150 eggs, which hatch in 10–20 days. The larvae mine in the roots and may migrate from one root to another and thus infest adjoining healthy pines. They always tunnel upwards and eventually enter the lower part of the trunk, pupating between ground level and about 30 ins. above it. The pupal stage lasts 12–18 days. An Asilid of the genus *Laphria* is predacious on the adults, and poultry and other birds readily feed on them.

[NOVITZKIĬ (S.).] **Новицкий (С.). On two Chalcidoid Parasites of** *Zeuzera pyrina* **L.** [*In English.*]—*Rev. russe Ent.*, xxiii, no. 1–2, pp. 32–36, 5 figs. Moscow, 1929.

Descriptions are given of two parasites reared in August 1926 from young larvae of *Zeuzera pyrina*, L., in the Kherson Government (Ukraine), *viz.*, *Elasmus ciopkaloi*, sp. n., both sexes of which are described, and *Euderus* sp., which is not named owing to the imperfect condition of the single female obtained.

[AVERIN (V.) & NOVINENKO (A.).] **Аверін (В.) і Новиненко (А.). A Contribution to the Problem of the Control of Pests of Archives.** [*In Ukrainian*].—*Kharkiv. kr. sil.-gosp. dosvidna Stantz.*, Ent. Dept., no. 9, 7 pp., 5 figs., 8 refs. Kharkov, 1928.

Larvae of *Sitodrepa panicea*, L., severely damaged books and documents in a State Record Office in Kharkov in 1927. Experiments showed that fumigation with 3 oz. chloropicrin or 10 oz. carbon bisulphide to 50 cu. ft. did not damage the paper, coloured illustrations, photographs, etc. Chloropicrin at the same rate killed all exposed larvae in an hour, or at half the concentration in two. As, however, some of the fumigant is absorbed by the paper, a longer exposure was necessary to kill those in infested material, namely, 48 hours with 1 oz. to 50 cu. ft. or 24 hours with 2 oz. Carbon bisulphide killed all the larvae only when used at the rate of 1 oz. to 10 cu. ft. with an exposure of 48 hours, and when not more than a third of the fumigating chamber, which is briefly described, was occupied by the material under treatment. The danger arising from the inflammable nature of carbon bisulphide is pointed out. *S. panicea* also destroyed a number of dried specimens of plants in a herbarium.

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[Bondarovich (M. Ya.).] **Бондарович (М. Я.). Tobacco Dust as an Insecticide.** [*In Russian.*]—*Kharkov. oblastn. s.-kh. opuitn. Stantz.*, Ent. Dept., no. 11, 8 pp., 15 refs. Kharkov, 1929.

The value of tobacco dust in the control of insect pests is discussed from the literature, and an account is given of laboratory experiments on *Phyllotreta cruciferae*, Goeze, with a dust prepared from refuse obtained in the manufacture of tobacco from *Nicotiana rustica.* In all cases in which the beetles were paralysed, they subsequently died. They were paralysed in 1–2 minutes after coming in direct contact with the dust, and in 10–15 minutes when placed at a short distance (2–3 mm.) from it. Dust from a tin left open for 4 days required 25–30 minutes to paralyse the beetles when in direct contact and 3 hours when at a short distance from them. Dust exposed to the air for 21 days only affected the beetles by direct contact, paralysing them after 30–40 minutes. A tobacco extract spray containing 0·3 per cent. nicotine applied to a cabbage leaf, which was subsequently dried for an hour and placed in a jar containing flea-beetles, paralysed them in 15 minutes.

As the insecticidal power of tobacco dust depends on the amount of nicotine contained in it, it should not be mixed with a carrier. Its application undiluted for the protection of radish and cabbage seedlings against *Phyllotreta* spp. was very effective, but it proved of little value against Lepidopterous larvae and various Rhynchota, or against *Bruchus pisorum*, L., on peas. To protect the shoots of crucifers, the dust should be applied to the beds two days before the appearance of the cotyledons, and the latter should be treated as soon as they open ; cabbage seedlings should also be dusted immediately after transplanting. Better results are obtained by repeated applications of small amounts of dust at intervals of 5–6 days than by single applications of larger amounts, owing to the evaporation of the nicotine.

v. Butovitsch (V.). **Studien über die Morphologie und Systematik der Paläarktischen Splintkäfer.** [Studies on the Morphology and Classification of the Palaearctic Cambium Beetles.]—*Stettiner ent. Ztg.*, xc, no. 1, pp. 1–72, 8 pls., 9 figs., 79 refs. Stettin, 1929.

The author discusses the synonymy of the genus *Scolytus* and classifies the Palaearctic species, chiefly on characters of the male genitalia and the proventriculus. He erects a new subgenus, and proposes new names for several groups of species. A key to the Palaearctic species and a list of all the species of the genus are appended.

Velaz de Medrano (L.). **Ensayos de procedimientos de extinción de plagas de** *Tortrix viridana* **L.** [Experiments with Measures against *T. viridana.*]—*Rev. Biol. forest. Limnol.*, Ser A, i, no. 1, pp. 9–21. Madrid, 31st October 1929. (With a Summary in French.)

In experiments against *Tortrix viridana*, L., on oaks in Spain, sprays of lead arsenate (3·5 per mille) and sodium arsenate (0·75–1 per mille) gave very good results, calcium arsenate (5 per mille) being rather less effective. As injections of potassium cyanide (2–10 gm.) did not injure the trees, their effect on the larvae is to be tested. Light-traps for the moths proved of no value.

LOPEZ (A. G.). **Insectos que atacan a la vid. I. Piral.—Cochylis.—Eudemis.**—Cr. 8vo, 55 pp., 14 figs., 3 pls. Madrid, Minist. Econ. nac., 1929. **Altica.—Filoxera.**—Cr. 8vo, 64 pp., 21 figs., 4 pls. Madrid, Minist. Econ. nac., 1929.

These are popular booklets on vine pests in Spain, with notes on their control. The first deals with *Sparganothis pilleriana*, Schiff., which has one generation a year in Spain, *Clysia ambiguella*, Hb., which probably has two, and *Polychrosis botrana*, Schiff., which has three in favourable years, the third being the most harmful. The other pests discussed are *Haltica ampelophaga*, Guér., *Phylloxera* and *Ceratitis capitata*, Wied.

DOYER (L. C.). **Aantasting van boonen door** *Bruchus obtectus* **Say.** [The Infestation of Beans by *B. obtectus*.]—*Tijdschr. Plantenziekt.*, xxxv, no. 10, pp. 257–263, 1 pl., 2 refs. Wageningen, October 1929.

In Holland, peas and horse beans (*Vicia faba*) are attacked by *Bruchus* spp., but infestation of these does not increase in storage. Ordinary beans (*Phaseolus*) are seldom attacked, but when stored they have recently been found in some cases to be infested by *B. obtectus*, Say, which is not a field pest in Holland. As it may become very injurious, notes are given on its control.

ZACHER (F.). **Mehr Schädlingsbekämpfung in Lebensmittellägern.** [More Work against Pests in Food Stores.]—*Mitt. Ges. Vorratsschutz*, v, no. 6, pp. 74–76. Berlin, November 1929.

The annual damage by insects and mites to stored foodstuffs in the United States has been estimated to exceed £40,000,000. Similar losses are sustained in Germany and could to a large extent be prevented. This article contains a list of the principal pests of stored food products in Germany, recorded under their popular names only.

SCHMIDT (M.). **Blattlausfliegen (Syrphidae) als Vorratsschädlinge.** [Syrphids as Pests of Stored Products.]—*Mitt. Ges. Vorratsschutz*, v, no. 6, pp. 80–81. Berlin, November 1929.

An instance is recorded of the occurrence of large numbers of Syrphid larvae in several hundred tons of stored hemp seed in Brandenburg. The seed is used for poultry food and difficulty attended its sale. It is suggested that the preceding summer was unusually favourable to infestation of the plants by Aphids and this resulted in a great increase of Syrphids, until in autumn the supply of Aphids became inadequate for food. The Syrphid larvae, being then unable to pupate, hibernated between the leaves, favoured by a very mild winter, and were introduced into the seed during threshing.

FREUDENSTEIN (K.). **Results of Investigation of a German Case of Acarine Disease. (Preliminary Report.)**—*Bee Wld.*, x, no. 10, pp. 138–139. Camberley, Surrey, October 1929.

The presence of *Acarapis* [*woodi*, Rennie] in the tracheae of bees was unknown in Germany until recently, but in 1927 and 1928 cases of true acarine disease were discovered there and are discussed by the

author. There was no particular stage in the disease at which the bees tended to leave the hive. The author gives a description of the thoracic tracheae of the bee, which does not altogether agree with the accepted views on the structure, and points out that some of the thoracic tubes are so small that they can be entirely blocked by a single mite. He concludes that some of the flight muscles may be put out of action by the hindrance to respiration caused by infestation, and also that diseased bees, becoming restless, leave the hive in winter and so die. Crawlers were kept alive indoors for a considerable time (up to 20 days), and in experiments the spread of infestation did not readily occur. Bees that had been with infested ones were found in several cases to harbour mites under the prothoracic flap, where the mites had evidently been breeding without entering the spiracle. Apparently the first spiracle is attacked rather than the third (which is large enough for a mite to enter) because of the space under the flap in which they can accumulate, and mites so situated may block the spiracle and make the bee a crawler without actually entering the trachea. The author suggests that remedies in vapour form act only on mites under the flap, where the numbers are small, and that once a female succeeds in entering the trachea, multiplication is rapid and the bee becomes diseased.

Greulich (—). **Bekämpfung des grossen braunen Rüsselkäfers** (*Hylobius abietis*). [Measures against *H. abietis.*]—*Deuts. Forstztg.*, xliii, 1928, pp. 302–303. (Abstract in *Neuheiten PflSchutzes*, 1929, no. 3, p. 79. Vienna, September 1929.)

A new method that has proved successful against *Hylobius abietis*, L., in Germany is described. Prior to felling, the lower part of the trunk and the large side roots are exposed and barked, and all shrubs, humus, etc., are cleared away, so as to deprive the weevil of suitable breeding and hibernation places. The timber is barked immediately after felling and is removed by autumn, after which the ground is cleared of twigs and bark, the larger twigs being burnt. During the whole of the following summer, sheep are driven on the ground to trample on any weevils that may come into the felled area. In autumn preparations are made for new planting, after which the sheep may be pastured anew, but care must be taken to see that sufficient food is available for them, so that they do not eat the young seedlings.

Schimitschek (E.). **Moderne Bekämpfung forstlicher Schädlinge.** [Modern Measures against Forest Pests.]—*Zbl. ges. Forstwesen*, lv, pp. 1–18. Vienna, 1929. (Abstract in *Neuheiten PflSchutzes*, 1929, no. 3, pp. 80–81. Vienna, September 1929.)

In discussing the use of insecticides against forest pests, the author points out that the different insects vary in their resistance to arsenicals. *Melolontha* and *Hylobius* are not affected, and only partial mortality is obtained with *Strophosomus* spp., but such Chrysomelids as *Phyllodecta vulgatissima*, L., are highly susceptible. Arsenic acts in decreasing order of toxicity on *Diprion* (*Lophyrus*) *pini*, L., *Tortrix viridana*, L., *Lymantria monacha*, L., *Porthetria dispar*, L., and *Dendrolimus pini*, L.

GESSNER (A.). **Erdraupen als Rebenschädlinge.** [Cutworms as Vine Pests.]—*Weinbau u. Kellerw.*, 1928, no. 23, p. 185. (Abstract in *Neuheiten PflSchutzes*, 1929, no. 3, p. 82. Vienna, September 1929.)

Agrotis ipsilon, Hufn., caused severe injury in July 1928 to vines in a nursery in Baden. *A. pronuba*, L., attacked the buds of vines in a vineyard and also occurred on other plants, but most of the larvae died before pupation, apparently owing to infestation by a fungus of the genus *Tarichium*.

KLOTTER (—). **Die Behandlung der Telegraphenstangen zum Schutz gegen pflanzliche und tierische Schädlinge.** [The Treatment of Telegraph Poles for Protection against Fungi and Insect Pests.] —*Badische Bl. angew. Ent.*, ii, no. 7, pp. 339–368, 7 figs., 6 refs. Freiburg i. Br., June 1929.

This paper describes the treatment of telegraph poles with chemicals against insects and fungi, by the methods of filtration under hydrostatic pressure, impregnation by soaking, and forcing under high pressure. The first method is no longer used in Germany, but there are still standing in Baden some 15,000 poles so treated with copper sulphate 20 years ago. In the second, a 0·66 per cent. solution of mercury bichloride is allowed to soak into the dry, seasoned wood at ordinary temperatures. The solution penetrates to a depth of ¾ in. in 30–35 days. Poles impregnated with mercury bichloride have a life of about 17 years. By a modification of the third method, which consisted of forcing tar-oil into the wood in closed iron containers under a pressure of one atmosphere and over, the poles are subjected first to high air-pressure (1½–4 atmospheres) in order to fill the cells with air, so that the tar-oil, which is then applied under a pressure of up to 7 atmospheres, cannot fill them but only impregnates their walls. Nitrophenols are sometimes used instead of tar-oil.

Brief notes are given on some of the insect pests infesting timber in Germany, of which *Hylotrupes bajulus*, L. [*R.A.E.*, A, xvii, 327] is the most important.

KOTTE (W.). **Die Kirschblütenmotte** (*Argyresthia ephippiella* **F.**) **und ihre wirtschaftliche Bedeutung.** [The Cherry Blossom Moth, *A. ephippiella*, and its economic Importance.]—*Badische Bl. angew. Ent.*, ii, no. 7, pp. 372–375, 1 fig. Freiburg i. Br., June 1929.

The data obtained from recent observations on the biology and control of *Argyresthia ephippiella*, F., on cherry in Baden are similar to those recorded from Switzerland [*R.A.E.*, A, xvi, 612].

PANNEWITZ (E.). **Systematik und Methodik der Schädlingsbekämpfungsmittel, unter besonderer Berücksichtigung der Patentliteratur.** [A Survey of Materials used against Pests with special Reference to Patent Specifications.]—*Z. Desinfekt.*, xxi, nos. 1, 6, 7, 9–12, pp. 18–21, 156–158, 174–178, 216–222, 248–252, 271–272, 297–300, 12 refs. Dresden, January, June, July, September–December 1929.

This is a list of insecticides, etc., patented in Germany, classified according to their composition and indicating the pests against which their use is suggested.

KARRER (S.). **Bekämpfung der japanischen Heuschrecke.** [Measures against the Japanese Grasshopper.]—*Möllers Dtsch. Gärtner-Ztg.*, xlix, 1929, pp. 152–153. (Abstract in *Zbl. Bakt.* (2), lxxix, no. 15–22, p. 474. Jena, 19th November 1929.)

Bran, placed between the pots in a greenhouse, attracts the grasshopper, *Tachycines asynamorus*, Adel. (*Diestrammena marmorata*, auct.), so that collection is rendered easy.

BERTONI (A. W.). **Instrucciones para combatir la agalla de la hoja de la Yerba mate.** [Instructions for combating the Leaf-gall of Maté.]—*Bol. Direcc. Agric. Paragua.*, no. 19 (1927) 1928, reprint 2 pp. (Abstract in *Zbl. Bakt.* (2), lxxix, no. 15–22, p. 477. Jena, 19th November 1929.)

The Psyllid, *Metaphalara* (*Paurocephala*) *spegazziniana*, Lizer, often causes galls on the leaves of the maté plant [*Ilex paraguayensis*] in Paraguay, the tea from which is spoilt. Spraying with tobacco extract mixed with a little soft soap is advised.

BERNHARD (—). **Borkenkäferfrass im Naturwald.** [Bark-beetle Injury in a Natural Forest.]—*Forstl. Z. Silva*, xvi, 1928, pp. 413–414; xvii, 1929, p. 111. (Abstract in *Zbl. Bakt.* (2), lxxix, no. 15–22, p. 478. Jena, 19th November 1929.)

Picea orientalis is severely attacked by *Ips sexdentatus*, Börn., on the south-western coast of Georgia. Since 1921–22 this beetle has greatly increased owing to neglect of the former practice of removing all affected trees.

HELLWIG (—). **Beiträge zur Kiefernspannerbekämpfung.** [Contributions to the Control of the Pine Moth.]—*Forstwiss. Zbl.*, li, 1929, pp. 327–331. (Abstract in *Zbl. Bakt.* (2), lxxix, no. 15–22, p. 479. Jena, 19th November 1929.)

An instance is recorded of an extensive stand of larch, spruce and pine in the Palatinate remaining untouched by *Bupalus piniarius*, L., after the pure forest of pine surrounding it had been defoliated. Digging the soil exposes the pupae to birds, etc.

WERDER (O.). **Zur Frage der Systematik der "Schwarzen Blattläuse."** [On the Question of the Classification of the "Black Aphids."]—*Mitt. schweiz. ent. Ges.*, xiv, no. 5, pp. 178–180. Berne, 30th December 1929.

Of the various "black Aphids," Davidson and Theobald consider that *Aphis viburni*, Scop., *A. ilicis*, Kalt., *A. hederae*, Kalt., and *A. rumicis*, L., are distinct species and that the other described forms are synonyms of the last-named, whereas Börner, Mordvilko and others regard these forms as representing a number of species differentiated mainly biologically but with very slight morphological differences [*cf. R.A.E.*, A, x, 505; xiv, 193; xv, 464, etc.]. The author doubts whether this classification is sound, as the characters adduced seem of doubtful stability, and may be merely the result of differences in food-plant, climate, etc.

OUDEMANS (A. C.). **Acarologische Aanteekeningen XCIX, C.** [Acarological Notes, XCIX, C.]—*Ent. Ber.*, viii, nos. 169–170, pp. 11–20, 28–36. Amsterdam, 1st September–1st November 1929.

In the first note, *Typhlodromus bulbicolus*, sp. n., is recorded in rotting bulbs of *Lilium* imported into Holland from America. The author considers that *Bryobia ribis*, Thomas, which was abundant on gooseberry in Holland in some localities, is identical with *B. praetiosa*, Koch. New species described in the second note are *Typhlodromus domesticus* from smoked meat, etc., but probably preying on pests infesting it, *T. mali* and *T. pomorum* from apple, and *T. pruni* from plum, all in Holland; and *T. tineivorus*, parasitising *Sitotroga cerealella*, Ol., in a breeding cage in Illinois.

BLATTNY (C.). **Zajimavé nálezy škůdců rostlin v r. 1929.** [Interesting Discoveries on Plant Pests in 1929.]—*Ochrana Rostlin*, ix, no. 3–4, p. 95. Prague, 1929.

The Hydrophilid, *Cercyon analis*, Payk. (*flavipes*, Thunb.), not previously observed in Czechoslovakia, was found near Prague in 1929, gnawing the stems of cucumber plants in greenhouses. *Apion apricans*, Hbst., was very abundant on celery, although it has previously been recorded as a pest of clover only, and *Adoxus obscurus*, L., was numerous on raspberry bushes, feeding on the bark.

[CHORBADZHIEV (P.).] **Чорбаджиев (П.). Pests of cultivated Plants in Bulgaria during 1927.** [*In Bulgarian.*]—*Svedeniya po Zemled. period. Byul.*, x, no. 3–4, pp. 3–59, 14 refs. Sofia, March–April 1929. (With a Summary in French.)

This is a list of 233 injurious insects recorded during 1927 in Bulgaria, with notes on their local and seasonal distribution and food-plants, and in many cases on measures for their control. The more important pests included the following not mentioned in previous reports [*R.A.E.*, A, xvii, 252, 594]: *Pyrausta nubilalis*, Hb., on hemp and sometimes on maize; *Cydia funebrana*, Tr., on plums; *Capnodis tenebrionis*, L., on various fruit trees; and *Agrilus viridis*, L., on roses.

Species recorded for the first time were *Loxostege* (*Phlyctaenodes*) *nudalis*, Hb., on beet; *Anthaxia aurulenta*, F. (*deaurata*, Gmel.) on pears and sometimes cherries; *Otiorrhynchus fullo*, Schr., on plums, apples and pears; *Labidostomis sibirica amurensis*, Heyd., on a variety of fruit trees; *Helops laevioctostriatus*, Goeze, on vines; *Phyllobius rhodopensis*, Apf., on young pines (*Pinus nigricans*); and *Hypera meles*, F., on lucerne.

[GRADOJEVIĆ (M.).] **Градојевић (М.).** *Reticulitermes lucifugus* **Rossi, a new Pest of Vineyards and Mulberry Trees in southern Serbia.** [*In Serbian.*]—*Bull. Min. Agric.*, vii, no. 27, reprint 16 pp., 15 refs., 4 pls. Belgrade, 1929. (With a Summary in French.)

This is a popular account of the bionomics of *Reticulitermes lucifugus*, Rossi, in southern Serbia. The geographical distribution and

systematic position of this termite are discussed. Numerous colonies were observed in 1928 infesting vine stocks; as their presence is generally not recognised, the damage they cause is often attributed to *Phylloxera*. Telegraph poles may be hollowed out to such an extent that they are easily blown down by wind. In some places the roots and trunks of mulberry trees are attacked, and the author considers it possible that the termites transmit a disease, similar to mosaic, which has been spreading of recent years and affects either the whole or parts of the crowns of the trees.

[Vukasović] Voukassovitch (P.). **Contribution à l'étude de** *Macrocentrus abdominalis* **F., et de ses parasites. (Hymén. Braconidae.)**—*Ann. Soc. ent. Fr.*, xcviii, pt. 1–2, pp. 163–187, 25 figs., 12 refs. Paris, 30th June 1929.

A more detailed account is given of the bionomics of *Macrocentrus abdominalis*, F. [*R.A.E.*, A, xv, 206] in Serbia, with a description of the larval and adult anatomy. Its parasites include *Hemiteles laevigatus*, Rtzb. (previously referred to as *Hemiteles* sp.) and, very rarely, *Elasmus flabellatus*, Boy.

[Popov (K. I.).] **Попов (К. И). Beiträge zur Kenntnis der schädlichen Zwiebelparasiten in der Tatarischen Republik.** [Contribution to the Knowledge of Pests of Onion in the Tartar Republic. (*In Russian.*)]—*Izv. Kazansk. Inst. sel'sk. Khoz. Lesov.*, v, no. 1, pp. 50–80, 15 refs. Kazan, 1929. (With a Summary in German.)

This is a detailed account of observations on pests of onions carried out in and near the town of Kazan on the Volga in 1925–26, where they are extensively grown. The chief pest of stored onions is the mite, *Rhizoglyphus hyacinthi*, Boisd., which was sometimes responsible for the putrefaction of 50–70 per cent. of them. When kept in dry places and scattered on the floor or shelves, the infested onions did not rot, but became brittle and very light in weight. When, however, they were stored in heaps in damp cellars or kept in large baskets, the infestation resulted in complete putrefaction. Experiments indicated that the mites are the primary cause of the decay, exposing the healthy tissues of the onions to bacteria that decompose them. Large, succulent onions decay most readily, and injured ones are more easily infested. A comparatively high temperature and very high humidity are especially favourable to the mites; under dry conditions they diminish in size and most of them assume a hypopal form. They also attack onions in the field, causing them to rot and the leaves to dry. When decayed, the stored onions were also infested by various Dipterous larvae and by mites of the genus *Holostaspis*, the latter being sometimes predacious on *Rhizoglyphus*. For the control of *R. hyacinthi* the onions should be carefully selected before planting, and those that begin to decay in the soil should be dug out and destroyed. Prior to storage the onions should be dried in the sun, or slightly smoked over a slow fire. They should not be stored in heaps, and should be examined monthly, infested ones being removed. In the summer the storage

rooms should be aired and cleaned, and the walls and floor washed with freshly slaked lime (15–20 lb. in 12 gals. water).

Another mite observed in healthy stored onions was *Eriophyes* sp.; it does not, however, cause them to decay.

Of the pests attacking onions in the field, the most important were *Hylemyia antiqua*, Mg., and *Eumerus strigatus*, Fall., the larvae of the former first appearing in the middle of June, and those of the latter at the beginning of July. The adults of *H. antiqua* occurred from the middle of June till the beginning of September, but those of *E. strigatus* were not observed in nature. Elaterid larvae were the next in importance, being particularly harmful in the first half of the summer. *Ceuthorrhynchus jacovlevi*, Schulze [*cf.* *R.A.E.*, A, xviii, 54] and *Phytomyza atricornis*, Mg., were very common; they mine in the leaves of the onions, those planted early being most severely damaged. In the second half of July the larvae of *P. atricornis* were sometimes accompanied by those of *Hydrellia* sp., which, however, were not numerous. Lepidopterous larvae, probably *Gortyna* (*Hydroecia*) *micacea*, Esp., in some places hollowed out 70–100 per cent. of the onions.

[SHCHEGOLEV (V. N.) & MAMONOV (B. A.).] **Щеголев (В. Н.) и Мамонов (Б. А.). The Soy Bean Pests in the northern Caucasus.** [*In Russian.*]—*Byull. Sev.-Kavkazsk. Kraev. sel.-khoz. opuitn. Sta.*, no. 287, 32 pp., 6 figs., 19 refs. Rostov-on-Don, 1929. (With a Summary in English.)

Brief notes are given on the biology and economic importance of 43 pests of soy beans [*Glycine hispida*] observed in the northern Caucasus in 1927–28, with a key for their determination in the stages in which they attack the plants, based on their morphological characters and the injury caused.

The most important pests were *Heliothis* (*Chloridea*) *dipsacea*, L. [*R.A.E.*, A, xvii, 263], *Tetranychus telarius*, L. (*Epitetranychus althaeae*, von Hanst.), which infested 98 per cent. of the leaves, being especially favoured by the high temperature and drought that prevailed in the summer of 1928, *Phorbia* (*Hylemyia*) *cilicrura*, Rond., and *Etiella zinckenella*, Tr. The larvae of *P. cilicrura* destroyed 20 per cent. of the beans sown in the soil in the second half of May; most of them pupated early in June, the adults emerging later in the month. Much of the information on *Etiella zinckenella* is similar to that already noticed [xiv, 29, 647]; all stages are described and a list of 23 food-plants is given. In 1928 the life-cycle from egg to adult lasted 74 days. About 33 per cent. of the larvae migrate from one pod to another. Parasites bred from the larvae additional to those previously recorded [xiv, 29] were *Pimpla ventricosa*, Tschek, *Pristomerus vulnerator*, Panz., var., *Eupelmus urozonus*, Dalm., and *Euplectrus bicolor*, Swed. Although white and yellow acacia [*Robinia* and *Caragana*] are usually considered to be the chief food-plants of *E. zinckenella*, soy beans may be infested in places where they do not occur, as the moth develops on wild leguminous plants.

Phytometra (*Plusia*) *gamma*, L., and *Loxostege sticticalis*, L., were not abundant in 1928, but sometimes cause severe damage to soy beans.

A list of soy bean pests occurring in countries outside the Russian Union is appended.

[RIMSKIĬ-KORSAKOV (M. N.).] **Римский-Корсаков (М. Н.). Insect Pests of Trees in the Plantations of the Forestry Institute.** [*In Russian.*]—*Mitt. Leningr. Forstinst.*, xxxvii, pp. 269–300, 20 figs., 20 refs. Leningrad, 1929. (With a Summary in German.)

This is a popular survey of 53 species of insect pests observed in the plantations of the Forestry Institute in Leningrad, with brief notes on their bionomics, control measures being indicated in some instances. The following species were the most important: *Tortrix viridana*, L., on oak; *Coleophora laricella*, Hb., on larch; *Enarmonia* (*Epinotia*) *rufimitrana*, H.S., attacking *Abies* spp., particularly *A. balsamea*, but not *A. pectinata*, *A. nordmanniana* or *A. concolor*; *Abraxas sylvata*, Scop., on elm and *Prunus padus*; and *Phytodecta quinquepunctata*, F., on *Prunus padus*.

ROHDENDORF (B.). **Sarcophagiden-Studien. I.—Beiträge zur Kenntnis der Gattung** *Blaesoxipha* **Lw.**—*Zool. Anz.*, lxxvii, pp. 23–28, 4 figs. Leipzig, May 1928.

Blaesoxipha filipjevi, sp. n., a parasite of the larvae and adults of *Locusta migratoria*, L., is described from the northern Caucasus [*cf.* *R.A.E.*, A, xvii, 261, 398].

HARGREAVES (E.). **Report on the Entomological Section. Section I.**—*Rep. Lds. For. Dept. Sierra Leone 1928*, pp. 20–22. Freetown, 1929.

Sahlbergella singularis, Hagl., and *S. theobroma*, Dist., two important pests of cacao in the Gold Coast, were recorded from Sierra Leone in 1928, but only one individual of each was collected, neither being on cacao. Fruit-piercing Lepidoptera were prevalent on orange, grapefruit, tangerine and sweet lime, though absent on lemon and lime. Those observed at night were the Noctuids, *Othreis fullonica*, L., *Achaea catocaloides*, Gn., *A. lienardi*, Boisd., *Hypocala rostrata*, F., *Erebus walkeri*, Butl., and *Dermaleipa rubricata*, Holl., whereas the Nymphalid, *Charaxes numenes*, Hew., attacks the fruit during the day. They are present mainly between April and June, and to a smaller extent during November, some of the species also attacking the fruits of cashew [*Anacardium occidentale*] and mango. As many as four moths may be seen feeding on a single fruit.

Injury by *Aspidiotus destructor*, Sign., to coconut was reduced to a minimum by its natural enemies [*cf.* *R.A.E.*, A, xvii, 352], which are now widely distributed. A few coffee plants were severely infested by a mealybug, which was attacked by a Hymenopterous parasite and by a predacious Lycaenid larva. *Blastobasis byrsodepta*, Meyr., was bred from stored ginger. The Aphid attacking groundnuts [*Arachis hypogaea*] [xvi, 245] has been identified as *Aphis laburni*, Kalt. A Capsid, *Halticus tibialis*, Reut., occurring in large numbers on groundnut and certain weeds, is considered to be, like *A. laburni*, a possible vector of rosette disease. Experiments are in progress to determine the value of a strong jet of water directed against the nymphs at suitable intervals as a means of controlling the Psyllid, *Mesohomotoma tessmanni*, Aulm., which attacks kola [*Cola acuminata*]. In experiments against *Balanogastris kolae*, Desbr., infesting the nuts of kola, nuts placed in brine remained in good condition, but were rendered

unpalatable. Fumigation with carbon bisulphide or hydrocyanic acid gas destroyed the weevils but badly discoloured the nuts. *Anomis leona*, Schs., and *Busseola fusca*, Fuller, have been bred from the stalks of maize. A number of Coccids, including *Pseudococcus brevipes*, Ckll., are becoming numerous on the fruit heads of oil palms [*Elaeis guineënsis*]. They hide between the bases of the fruits and are covered with earth placed on them by ants, so that no spray will reach them. Oil palms in one plantation have been killed by an unidentified Lepidopterous larva, which infests the centre of the plant.

The first egg masses of *Zonocerus variegatus*, L., were found in September and began to hatch at the end of the month, each mass containing 20–80 eggs. In some areas there was more than one mass to each square inch of surface. The adults select two-year-old bush for oviposition, and breeding areas are generally localised. Hatching continued until the end of December. Large numbers of egg masses were dug up, and little trouble is anticipated in treated areas. Experiments are in progress with a view to reducing the amount of Paris green and salt used in poison baits, which have been found very effective against the adults [xv, 489].

Good results were obtained in the treatment of imported *Citrus* stock attacked by termites with carbon bisulphide, applied at the rate of 10 cc. to each plant by means of a soil injector, at a distance of 8 inches from the plant and at a depth of 3 inches; and with paradichlorobenzene at the rate of $\frac{1}{4}$ oz. to each plant, distributed in a circle of 3 inches radius and at a depth of 2 inches, the soil being afterwards replaced. New shoots nearly 1 ft. long were produced within a week of treatment. Termite mounds also have been successfully treated with carbon bisulphide, and Paris green dust has been found effective against termites in houses when brushed over floors or shelves at the rate of 1 oz. to 12 sq. ft. and allowed to remain for 2 or 3 weeks, with re-brushing at intervals. Paris green may also be used as a paint on window frames, and experiments are proposed for injecting it into the mounds by means of a dusting machine.

INNES (F. A.). [**Entomological Notes.**]—*Ann. Med. Sanit. Rep. Gambia 1928*, p. 20. London, 1929.

Dermestes vulpinus, F., is recorded as destroying the bristles and glue of brushes in Gambia, and *Anthrenus pimpinellae*, F., as causing considerable damage to dried fish in the market.

[KING (H. H.).] **Report of the Government Entomologist for the Year 1927.**—*Bull. Wellcome Trop. Res. Lab.*, Ent. Sect. no. 25, 7 pp. Khartoum, January 1928. [Received 1929.]

Large swarms of *Schistocerca gregaria*, Forsk., reappeared in 1927 in the Sudan after an absence of 10 years. The first swarm reported, consisting of newly matured individuals that had probably passed their hopper stage on the Red Sea coast, was observed in May in the Nubian Desert; it proceeded southwards and westwards and was lost sight of. The locusts of the main immigration, which occurred in the second half of July and early in August, are believed to have been bred in Abyssinia, whence they proceeded north and west, passing

through Eritrea and afterwards spreading through those areas of the Sudan subject to locust invasion. Oviposition started almost immediately, and although large numbers of the hoppers, which appeared in August, were destroyed, many attained maturity. Adults of the succeeding generation were on the wing by the middle of September, and the return migration to the east started shortly afterwards. Other flights proceeded north and arrived in Egypt towards the end of October, and the Sudan was free from swarms by November except on the Red Sea coast, where winter rains occur, and where one or more large swarms remained to breed. Of the control measures adopted, the best results were secured with poison bait [*R.A.E.*, A, xvii, 507]. The damage caused by the locusts, though serious locally, was relatively light in proportion to the numbers present.

Extensive field investigations have shown that damage to the cotton crop by termites is relatively slight [*cf.* xvi, 166]. A survey of the incidence of *Selenothrips* (*Heliothrips*) *indicus*, Bagn., on cotton plants grown under different conditions showed late sown and lightly watered cotton to be most severely attacked. A great numerical disparity between the immature and mature thrips present on the leaves indicated heavy mortality among the pupae. *Platyedra gossypiella*, Saund., caused no appreciable damage except in the Gezira area, where, owing to heavy yield and low prices in the preceding season, large quantities of seed cotton had been stored by the natives. A campaign carried out in this area resulted in the destruction of 424,000 bollworms.

Experiments are to be made in breeding *Microbracon brevicornis*, Wesm., and *M. kirkpatricki*, Wlkn., on a large scale with the idea of carrying them through the early summer months, when it is believed that mortality in the parasites of bollworms is high. It is thought that the release of stocks so bred at the time when the first broods of bollworms are maturing might produce good results. The hosts of *M. brevicornis* include *Diparopsis castanea*, Hmps., *Earias insulana*, Boisd., *P. gossypiella* and *Sesamia cretica*, Lederer. There is evidence to show that it has only recently acquired the habit of parasitising *D. castanea* ; in a locality where the latter was a very serious pest of cotton in 1926–27 and showed no sign of parasitism, it was almost absent from the crop of 1927–28, 25 per cent. of the larvae collected early in the season being parasitised by *M. brevicornis*. *M. kirkpatricki* is a parasite of *P. gossypiella* in Kenya [xvi, 49], and arrangements were made to import it into the Sudan, but it was subsequently found to be indigenous there, though its habits and distribution are unknown.

Damage estimated at over £50,000 was caused to millet [*Sorghum*] in 1927 by *Agonoscelis versicolor*, F. [xvii, 657]. In experiments to determine the best method of destroying this Pentatomid when it collects in clusters during the dry season, a paraffin spray gave satisfactory results.

Cros (A.). **Note sommaire sur les parasites des oothèques des sauterelles marocains.**—*Bull. Soc. Hist. nat. Afr. N.*, xx, no. 6–7, pp. 141–142. Algiers, 1929.

Mylabris (*Zonabris*) *silbermanni*, Chevr., and *Trichodes flavocinctus*, Spin. (*x-littera*, Chevr.) were bred from egg-pods of *Dociostaurus maroccanus*, Thnb., received from Frenda (Algeria). Bombyliid larvae also occurred in the egg-pods.

Lavigne (A.). **Les jeunes vignes et les larves de taupins.**—*Bull. agric. Algérie,* xxxv, no. 10, pp. 187–188. Algiers, October 1929.

Elaterid larvae are very injurious in Algeria in young plantations of cotton, tobacco and vines. Newly planted cotton seed should not be covered with manure that is likely to be infested. Vines are the most severely damaged, however, as the wireworms attack the new shoots of the graft, causing cessation of growth and withering; this happens most frequently when cereals have previously been grown in the field. To avoid this injury, the graft should only be covered with the lightest possible layer of earth, even though it may mean covering it again because it is almost exposed. As soon as the shoots have begun to harden, the attacks of wireworms cease. When wireworms are present, the graft should be unearthed and the larvae collected and destroyed; afterwards it should be earthed up again with a little dry and not too fine soil.

Alfieri (A.). **Les principaux insectes nuisibles infestant le jardin de Nouzha.**—*Bull. Soc. roy. ent. Egypte,* 1929, fasc. 1–3, pp. 7–8, 1 plan, 1 fldg. table. Cairo, 1929.

A table is given showing the principal pests of trees and other plants, many of which are of economic importance, observed in the gardens of Nouzha and Antoniadis (Alexandria), including 2 mites and 25 insects, of which 24 are Coccids.

Mistikawy (A. M.). **The Locust Problem in Egypt and its Relation with other Countries.**—*Bull. Soc. roy. ent. Egypte,* 1929, fasc. 1–3, pp. 29–41, 1 diagr., 1 map. Cairo, 1929.

The author outlines the general distribution of *Schistocerca gregaria,* Forsk., and reviews its recent invasions of Egypt, which took place in 1891, 1904, 1914, 1915, 1927 and 1928. There is no direct evidence that it breeds constantly in Egypt; it has three principal breeding centres, *viz.*, the eastern, which lies in Arabia, probably in Nejd, the central, in the eastern Sudan, Eritrea and Abyssinia, and the western, in the north-western Sudan. The routes followed by the locusts migrating from these centres are discussed; Egypt lies in the way of most serious migrations, and its locust problem is linked up with that of the surrounding countries.

The locusts have been bred in cages for two successive generations, some crowded in one cage, others kept singly. The adults in both cases behaved in a manner characteristic of *S. gregaria* ph. *solitaria* (*flaviventris*, Burm.), and the author concludes that crowding is not the only factor determining the transition from one phase to another. Females have been observed to oviposit from 3 to 7 times; from laboratory studies the author is inclined to believe that *S. gregaria* has three generations a year.

In experiments on control, successful results were obtained with flame throwers, contact sprays of pyrethrum soap or fish-oil emulsion, poison baits, and heavy dusting with sodium fluosilicate.

Other Acrididae of economic importance in Egypt, the distribution of which is briefly indicated, are *Anacridium aegyptium,* L., *Euprepocnemis plorans,* Charp., *Epacromia* (*Aiolopus*) *strepens,* Latr.,

Catantops axillaris, Thnbg., and *Thisoecetrus littoralis*, Ramb. Only the solitary phases of *Locusta* (*Pachytylus*) *migratoria*, L. (*danica*, L.) and *Calliptamus* (*Caloptenus*) *italicus*, L., have been found in Egypt.

Pitman (C. R. S.). **The economic Importance of Birds in Uganda and Parts of Kenya Colony from the Point of View of Locust Destruction.** —*Bull. Soc. roy. ent. Egypte*, 1929, fasc. 1–3, pp. 93–103. Cairo, 1929.

From mid-February to 20th April 1929, while touring the districts of Gulu and Lango (Uganda), the author made observations on birds feeding on locusts that were invading the country. Of the resident birds the marabout stork (*Leptoptilos crumeniferus*) and vultures (*Pseudogyps* and *Necrosyrtes*) destroy considerable numbers of locusts. The migrants that are of most importance in this respect are storks (*Ciconia* and *Sphenorynchus*), kites (*Milvus*), the desert buzzard (*Buteo vulpinus*), and bee-eaters (*Merops* spp.). Particulars are given as to the habits of these species, as well as a few general notes on other birds observed feeding on locusts. The maximum destruction of locusts is caused by birds between the 1st September and 30th April, for this is the period when the southern and northern passages of Palaearctic and north Ethiopian migrants and the breeding of resident storks, vultures, etc., take place.

Pettey (F. W.). **Codling Moth Control. Experiments with Summer Oil Sprays.**—*Fmg. S. Africa*, reprint no. 56, 13 pp., 5 figs., 1 ref. Pretoria, August–September 1929.

In continuation of previous experiments [*R.A.E.*, A, xvi, 305; xvii, 171, etc.] on the control of the codling moth [*Cydia pomonella*, L.], satisfactory results were obtained on apples by applying normal strength lead arsenate sprays (1¼ lb. to 40 gals.) twice and adding 1½ per cent. light oil to three or four of the later ones; on pears lead arsenate sprays alone were effective. The effect of summer oil sprays on the removal of spray residue is discussed; other conditions being equal, the greater the viscosity of the oil used with lead arsenate, the more difficult it proves to remove the spray residue by acid treatment. After four applications on apples of 1½ per cent. light or medium, or 1 per cent. heavy oil, with spreader, combined with 4 of 5 arsenate sprays, the spray residue was reduced below tolerance when the fruit was treated for 3 minutes in 1 per cent. hydrochloric acid. The injury caused to different varieties of apples by the use of summer oil sprays is described; oil of high viscosity, or of low when applied a number of times, causes a blackened area round the calyx in many varieties, and although the pulp is not affected, the marketable value of the fruit is lowered. With regard to pears, unless it can be proved that several applications of summer oil sprays with lead arsenate will be sufficiently effective against Coccids and mites to allow of the omission of a winter spray, the use of these oils is probably unwarranted. Experiments have shown that the summer oils alone will not control a severe infestation of mealybugs, but they may prevent an infestation from becoming severe; three summer applications of 2 per cent. light oil or 1½ per cent. medium kept mites in check. Recent attempts

to provide substitutes for lead arsenate in the control of *C. pomonella* are reviewed. No radical change in the present methods of control can be suggested ; the indications are that a programme may ultimately be adopted allowing the reduction of lead arsenate sprays to 2 or 3 applications, to be followed by 3 or more combination oil-nicotine, oil-pyrethrum or oil-derris sprays, and so obviating the necessity of removing arsenical residue. Light summer oils (1–1½ per cent.), with casein-lime spreader, combined with lead arsenate in the 2nd and 3rd and perhaps the 5th cover sprays can safely be used on pears under South African conditions, and on most varieties of apples, but several years' experience is necessary before definite recommendations can be made.

FRAPPA (C.). **Note sur un insecte redoutable pour les cultures de canne à sucre, de maïs et de riz à Madagascar.**—*Bull. écon. Madagascar,* Partie Document., xxv, pp. 110–113. Antananarivo, 1928.

A detailed account is given of the bionomics of the Dynastid, *Heteronychus plebeius*, Klug, on sugar-cane, etc., in Madagascar [*R.A.E.*, A, xiii, 616 ; xvii, 150]. On maize, the adults are very injurious, gnawing into the young shoots at the base, sometimes right to the centre. A few weeks after sowing, the infested seedlings show characteristic damage, being smaller in size and appearing dry and unhealthy ; gradually all the leaves turn yellow and the plant dies. On one area of nearly 200 acres only a few plants survived the attack. In the north of the Island, the adults are numerous in February and March, just below bunches of self-sown graminaceous plants that constitute the local pastures. Shoots of lima beans (*Phaseolus lunatus*) are also attacked. In rice-fields, the damage is particularly severe in dry seasons when water is scarce in the fields, the soil when humid but not wet being a most favourable medium for development of the beetle. In the vicinity of villages, the rice-fields are kept fairly clear by ducks, which devour the larvae.

It is suggested that maize might be grown as a trap-crop in sugar-cane fields. Manuring promotes the rapid lignification of the tissues of sugar-cane or maize, rendering the plants resistant to attack. Maize should not be grown on newly cleared land, but for preference following leguminous crops. Flooding will control an infestation in rice-fields. In general, cultural practices such as harrowing and weeding after ploughing will destroy many larvae and pupae as well as assisting the growth of the plants ; where possible the adults should be collected and destroyed.

ZOLOTAREWSKY (B.). **Notes sur les acridiens à Madagascar.**—*Bull. écon. Madagascar,* Partie Document., xxiv, no. 1, pp. 111–119, 6 pls., 2 refs. Antananarivo, 1927. [Received 1929.]

Madagascar is subject to invasions of *Locusta migratoria migratorioides*, Rch. & Frm., which breeds regularly in some parts of the Island. In the region lying between Onilahy in the south and Sofia and Bemarivo in the north, which has been studied by the author, the regular breeding grounds, whence the invasions always start, are

scattered on the plateaux lying to the west of the Isalo and Bongo-Lava groups of mountains. They are characterised by gradual slopes, light sandy soil, and a high level of subsoil water, the vegetation consisting principally of *Heteropogon contortus*, *Chrysopogon gryllus*, *Hyphaene shatan*, and in marshy places, *Phragmites communis*. Swarms migrate along the rivers to hills lying to the east of Bongo-Lava, where oviposition takes place. The resulting locusts join with swarms coming directly from the west, and invade the mountainous region in the centre of the Island, where breeding occurs only in a few sheltered situations.

The author briefly discusses the organisation of locust control and the measures that may be employed, including the use of poison baits, sprays or dusts against the hoppers, and their destruction by grass-burning or the use of flame-throwers, or by directing them into pits or trenches by means of sheet-iron barriers. The barriers found suitable under local conditions consist of 20 sheets of iron, each 16 ins. wide and 40 ins. long and weighing about 140 lb.

EDWARDS (W. H.). **La teigne du tabac,** *Phthorimaea operculella.*—*Bull. Dept. Agric. Ile Maurice*, Sér. sci. no. 13, 8 pp., 1 pl. Réduit, 1929.

Phthorimaea operculella, Zell., is very injurious to tobacco seedlings in Mauritius, where it also attacks other solanaceous plants, particularly potatoes. The life-cycle on tobacco is completed in 28–37 days, reproduction being continuous throughout the year. The characteristic larval mines in the leaf are found in young plants ; on older ones that are thoroughly established, only the two or three lowest leaves, which are of little commercial value, are generally attacked, and the growth of the plant is not affected. If, however, the larva penetrates the stalk, an excrescence is formed, the leaves wither away, and side shoots appear along the stalk. Large numbers of the larvae, in some localities as many as 46 per cent., are parasitised by the Ichneumonid, *Eulimneria stellenboschensis*, Cam., which oviposits on the larva within the mine and completes its life-cycle in about 20 days. The parasitised larva emerges from the mine and generally succeeds in pupating, the adult parasite leaving the cocoon shortly before the host would have appeared. A Braconid of the genus *Chelonus* and another Ichneumonid are much rarer parasites. It is suggested that when infested leaves are removed from the plants, they should be placed in cages with movable glass panels. As the parasites emerge they are attracted to the light, while any adults of *P. operculella* remain hidden under the leaves ; if the glass panels are quickly opened the parasites fly out before the moths have moved. Ants destroy many of the larvae when they emerge from the mines for pupation. Many moths may be collected by light traps, and seedlings should be protected from oviposition at night by a light covering. Insecticides might be useful when the larvae have just hatched or when they leave one leaf for another ; those suggested are $\frac{1}{2}$ lb. Paris green or $2\frac{1}{2}$ lb. lead arsenate in 100 gals. water. Solanaceous weeds should be kept down in the vicinity of tobacco fields, and dead leaves, etc., under which moths might shelter, should be removed and burnt. When leaves that could be used for manufacture are infested they need not be removed from the plant, but the larvae should be squashed *in situ* by hand.

D[UPONT] (P. R.). **De l'état actuel de la maladie des cocotiers causée par les cochenilles et des moyens employés pour la combattre.**—*Bull. Dept. Agric. & Pêche Seychelles*, no. 10, pp. 6–10. Victoria, Seychelles, April 1929.

A further account is given of the Coccids attacking coconut palms in the Seychelles [*R.A.E.*, A, xvi, 311; xvii, 650, etc.], where more than 50 species have already been identified, including, besides *Pinnaspis buxi*, Bch., and *Ischnaspis longirostris*, Sign. (*filiformis*, Dougl.), which are the principal ones, *Chrysomphalus* (*Aspidiotus*) *ficus*, Ashm., *C.* (*A.*) *dictyospermi*, Morg., *A. lataniae*, Sign., *C.* (*A.*) *ansei*, Green, *Pseudaonidia* (*A.*) *tribolitiformis*, Green, *Eucalymnatus* (*Lecanium*) *tessellatus*, Sign., and *Lepidosaphes* (*Mytilaspis*) sp., all of which are pests of long standing and are capable of killing the palms in certain seasons. The question of the introduction of natural enemies of the Coccids is discussed; it is hoped to import some insect enemies from East Africa, but with regard to fungi the introduction of fresh species is considered of doubtful value, and therefore every effort should be made to develop and disseminate those already occurring. Other practices are recommended as tending to reduce infestation. The soil should be improved as much as possible and coconut growing should be restricted to areas where the land is favourable to it. At a height of 700 to 800 ft. there is a distinct line of demarcation where infestation ceases, and the best possible remedy is to abandon the growing of coconuts in those areas that simply act as a reservoir of infestation from year to year. A system of drainage and terraces is outlined, with a scheme for the growing of green manure crops in order to improve the soil.

BODENHEIMER (F. S.) & KLEIN (H. Z.). **The Green Cicada—a new Insect Pest of Eggplants.** [*In Hebrew.*]—*Yedeoth, Proc. Agric. Expt. Sta.*, ii, no. 1–2 (11–12), pp. 524–527, 3 figs. Tel-Aviv, Palestine, July 1929. (With a Summary in English, p. 558.)

Empoasca (*Chlorita*) *signata*, Haupt, caused considerable damage to egg-plants [*Solanum melongena*] in Palestine in 1928, tomato and peppers [*Capsicum*] being also attacked. The Jassids occur on the lower surface of the leaves, which become discoloured and curl at the edges. They are most injurious during the summer and autumn months, decreasing in numbers at the beginning of the rainy season. Young plants are most severely attacked.

JEPSON (F. P.). **The Control of "Calotermes" in living Plants.**—*Bull. Dept. Agric. Ceylon*, no. 86, 11 pp. Colombo, August 1929.

This bulletin contains a report already noticed [*R.A.E.*, A, xvii, 568] on possible methods for dealing with infestation of tea bushes in Ceylon by *Calotermes militaris*, Desn., and *C. dilatatus*, Bugnion & Popoff, followed by an appendix giving the results of experiments on the introduction of Paris green into the parts of the bushes where the termites are active. It was found that the best method of accomplishing this is to bore a hole with a gimlet into the main cavities, into which the powder is then blown by means of an enema syringe of ball pattern, two or three squeezes of the bulb liberating about $\frac{1}{12}$ oz. of Paris green. It is important that the size of the hole should only

slightly exceed that of the syringe nozzle, in order to avoid blow-back of the powder. After application of the powder, the holes are sealed with cement or asphaltum. It is frequently difficult to detect attack, even in bushes that have been infested for years; during pruning, infestation often becomes evident, and it is suggested that some sign should be left on infested bushes by the pruners. The possibility of using a microphone or electric telephone for detecting infested bushes is being investigated, but no instrument suitable for field work has yet been devised, though delicate appliances for laboratory use are available. The termites begin to die a few days after treatment with Paris green, and in a few weeks masses of dead bodies block the passages, but 3 or 4 months must elapse before the entire colony is exterminated. Examination of dead individuals has revealed both insoluble and soluble arsenic in the bodies. In no case has this treatment resulted in any injury to the bushes, and analysis of the tea obtained from them has revealed no trace of arsenic. Treatment not only prevents the destruction of infested bushes but reduces the risk of infestation spreading from them. The treatment of infested stumps and snags of shade or green manure trees on tea estates to prevent the development of winged forms is also advocated; even under experimental conditions, the cost is low.

Quarantine Proclamation, no. 195.—*Commonw. Australia Gaz.*, no. 104, reprint 2 pp. Melbourne, 7th November 1929.

This Proclamation, dated 1st November 1929, supersedes previous ones so as to consolidate all the restrictions dealing with the importation of animals into Australia. As previously [*R.A.E.*, A, xvi, 632], the importation of insects or their parasites is prohibited, except for experimental purposes, or for combating pests or diseases, and subject to the approval of the Minister for Health.

Queensland: The Diseases in Plants Act of 1929.—Fol. 15 pp. Brisbane, 27th November 1929.

Under this Act, which repeals the Diseases in Plants Acts 1916–24, the Governor-in-Council may prohibit or permit only as prescribed the introduction into Queensland from any other State of Australia of any plant, etc., likely to carry any insect pest or disease, or the movement of any plant, etc., and may make regulations for the administration of the Act. All orchards, nurseries, etc., must be registered and are liable to inspection, and owners or occupiers may be ordered to take steps to eradicate any pest found. The Minister for Agriculture has power to quarantine any area.

JARVIS (E.). **High Temperatures prove fatal to Cane Beetles.**—*Queensland Agric. J.*, xxxii, pt. 4, p. 383. Brisbane, 1st October 1929.

Lepidoderma albohirtum, Waterh. (greyback cockchafer) is unable to withstand maximum shade temperatures of 95–98° F., when such conditions last for 36 hours and are accompanied by a warm land breeze. After enduring the heat for a few hours, the beetles congregate on the shady side of their feeding trees, but eventually fall to the ground

and die. On one occasion when the temperature was about 38° F. reared adults of *Ceromasia sphenophori*, Villen., were found on their backs in the breeding cage, but when the air became warmer most of the flies recovered. The occurrence of this temperature in September is apparently very unusual. It is suggested that if these Tachinids became numbed in the field they would be exposed to predators, but it is probable that they seek shelter on the approach of exceptionally cold nights.

LEVICK (G. T.). **Control of the Codling Moth** (*Cydia pomonella* **Linn.**).—*J. Dept. Agric. Victoria*, xxvii, pt. 9, pp. 533–542, 3 figs., 6 refs. Melbourne, September 1929.

The author continues his report on experiments in the control of *Cydia pomonella*, L. (codling moth) on apples in Victoria [*R.A.E.*, A, xvii, 47] to include the seasons 1926–29. With lead arsenate sprays alone the infestations amounted to 22, 13 and 58 per cent. respectively in the three seasons. Neither an increase of arsenate from 5 to 8 lb. in 80 gals. of water nor the addition of nicotine sulphate and lime-sulphur resulted in any increased efficiency. The addition of 1 gal. white oil emulsion to 80 gals. of lead arsenate spray only slightly improved its effect and increased the arsenic residue at picking time. Five applications of white oil emulsion alone at 2½ per cent. strength were not so effective as the same number of lead arsenate sprays. Hellebore (5 lb. to 80 gals.) was practically useless. In 1926–27 the percentage of first generation larvae entering the calyx of fruit that had not received a calyx spray varied from 33 to 50; these were almost completely controlled by a spray of 8 lb. lead arsenate in 80 gals. With two calyx sprays at a week's interval of 5 lb. lead arsenate in 80 gals., followed by 3 applications of 2½ per cent. white oil emulsion, the average percentage of infestation for two years was 12 as compared with 36 with lead arsenate alone.

The usual supplementary control measures in orchards and storage sheds are recommended.

JEWELL (W. R.). **Chemistry in Agriculture. Insecticides and Fungicides.**—*J. Dept. Agric. Victoria*, xxvii, pt. 9, pp. 566–569. Melbourne, September 1929.

This is a brief and popular review of the development of sprays, dusts and fumigants used against insects.

[MERINO (G.).] **Plant Pests Control Division.**—*28th Ann. Rep. Bur. Agric. Philipp. Is. 1928*, pp. 67–78, 7 pls. Manila, 1929.

The work carried out in the Philippines in 1928 against locusts [*Locusta migratoria migratorioides*, Rch. & Frm.] is reviewed, and a comparative list is given of the districts infested in 1927 and 1928. In spite of increased infestation, there was a marked improvement in the efficiency of the extermination campaign in 1928. The pit method and spraying with soap solution were employed with success against hoppers in isolated regions, and in inaccessible areas a mortality of 70 per cent. was secured among them by dusting with calcium arsenate at the rate of about 5½ lb. to the acre from aeroplanes.

Pests recorded during the year include: *Parlatoria ziziphus*, Lucas, *Rhynchocoris serrata*, Don., and *Prays citri*, Mill., on *Citrus*; *Crocidolomia binotalis*, Zell., on crucifers; *Ceratia* (*Orthaulaca*) *similis*, Ol., on cucumbers and tomatos; *Prodenia litura*, F., on peas; and *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) on coconut. Information dealing with sugar-cane pests has been noticed from another source [*R.A.E.*, A, xvii, 106–108]. *Cryptolaemus montrouzieri*, Muls., shows promise of becoming established in the Philippines, and it may be of use in controlling mealybugs attacking fruit trees and ornamental plants. A spray of 40 per cent. nicotine sulphate (1 : 500) proved effective against immature mango hoppers [*Idiocerus*] causing them to fall to the ground, where they were destroyed by *Solenopsis geminata*, F. The same insecticide, at the rate of 1 : 1,000, controlled *Toxoptera aurantii*, Boy., on *Citrus*.

Murayama (J.). **Revision des Coleoptères des Ipinae avec la description d'une nouvelle espèce.** [*In Japanese.*]—*J. Nat. Hist. Soc. Chosen*, no. 9, pp. 22–30, 1 pl. Keijo, Korea, 1929.

In Korea, *Ips typographus*, L., *I. acuminatus*, Gyll., and *Ips* (*Pityogenes*) *chalcographus*, L., are injurious to various pines, *Picea jezoensis* and *Larix dahurica koreana*. Pines are also attacked by *I. proximus*, Eichh., and *I. laricis*, F., and *L. dahurica koreana* by *I. cembrae*, Heer. *Ips* (*Pityogenes*) *seirindensis*, sp. n., infests *Picea jezoensis* and *Abies nephrolepis*.

Muramatsu (S.). **Studies on** *Hoplocampa coreana* **Takeuchi.** [*In Japanese.*]—*J. Plant Prot.*, xv, pp. 747–754. Tokyo, 1929.

The sawfly, *Hoplocampa coreana*, Takeuchi, is found throughout Korea, where it occasionally does serious damage to pear. It has one generation a year and has been observed hibernating in the prepupal stage in the soil. Pupation takes place from the middle of April, the adults appearing 6–9 days later and feeding on the nectar in the pear blossom. They may live as long as 11 days and lay their eggs in the blossom, 14–23 being deposited by a single female. The larvae, which hatch in 6–9 days, feed on the flowers and young fruits, 3–6 of which may be damaged by one larva during its feeding period of 14–17 days.

Tanaka (K.). **On** *Asura dharma* **Moore, a Pest of** *Citrus*. [*In Japanese.*]—*Kontyû*, iii, no. 4, pp. 262–264, 1 pl. Tokyo, 1929.

The larvae of the Arctiid, *Asura dharma*, Moore, appear in Kuishu in July and August and feed on the leaves of *Citrus*, *Cinnamomum pedunculatum*, *Pieris japonica* and *Cleyera ochnacea*, pupation taking place on the leaves at the end of August. The adults emerge in September.

Hussey (R. F.). **General Catalogue of the Hemiptera. Fascicle III. Pyrrhocoridae. With Bibliography by Elizabeth Sherman.**—Med. 8vo, 144 pp. Smith Coll., Northampton, Mass., 1929. Price, $1.50.

Among the most economically important species of *Dysdercus* dealt with in this catalogue are the following: *D. mimus*, Say (*albidiventris*,

Stål), *D. discolor*, Wlk. (*delauneyi*, Leth.), *D. ruficollis*, L. (*howardi* var. *minor*, Ballou), *D. cruciatus*, Montr. (*papuensis*, Dist.), and *D. cingulatus*, F. (*sidae*, Montr.). The cotton-stainer recorded as *D. neglectus*, Uhler [*R.A.E.*, A, xii, 395], which is apparently a *nomen nudum*, is *D. sanguinarius*, Stål. The following new names are proposed: *D. mimulus* for *D. mimus*, Stål, auctt., nec Say, *D. superstitiosus* var. *tergiversans* for var. *intermedius*, Schout. nec *D. intermedius*, Dist., and *D. poecilus* var. *vacillans* for var. *simplex*, Bredd. nec *D. simplex*, Wlk.

DUNN (M. B.). **On the Trail of destructive Timber Borer.**—*Canada Lumberman*, xlix (1929), no. 5, pp. 31–32, 2 figs. (Abstract in *Expt. Sta. Rec.*, lxi, no. 4, p. 358. Washington, D.C., September 1929.)

Timber-boring Longicorns, particularly the Lamiids, *Monochamus scutellatus*, Say, and *M. notatus*, Drury, are abundant and troublesome in nearly all parts of eastern Canada. Measures against them include placing the logs in water, as immersion kills the larvae within a few days; cutting the logs and skidding soon after an early spring fire; cutting during the winter after a late summer fire; covering skidways with balsam brush; and applying lime-sulphur dust to the skidways.

MARLATT (C. L.). **Report [1928–29] of the Chief of the Plant Quarantine and Control Administration.**—71 pp. Washington, D.C., U.S. Dept. Agric., 1929.

The activities of the Plant Quarantine and Control Administration for the year ending 30th June 1929 and the legislation enacted with regard to plant quarantines, etc., are reviewed, the pests dealt with being the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], the gipsy, brown-tail and satin moths [*Porthetria dispar*, L., *Nygmia phaeorrhoea*, Don., and *Stilpnotia salicis*, L.], which have increased in numbers in recent years, the European corn-borer [*Pyrausta nubilalis*, Hb.], the Japanese beetle [*Popillia japonica*, Newm.], the Asiatic beetles (*Anomala orientalis*, Waterh., and *Aserica castanea*, Arrow), the pink bollworm [*Platyedra gossypiella*, Saund.], the thurberia weevil [*Anthonomus grandis thurberiae*, Pierce], the Mexican fruit worm [*Anastrepha ludens*, Lw.], the date scale [*Parlatoria blanchardi*, Targ.) and the narcissus bulb-flies [*Merodon equestris*, F., and *Eumerus* spp.].

In connection with *Pyrausta nubilalis*, it is pointed out that the strain in New England is two, or more, brooded, whereas that originally established at about the same date in eastern and western New York and in Ontario has only one generation a year and appears to hold to that peculiarity with great tenacity, as shown by transfer experiments. The spread westward from the New England area of the two-brooded strain may increase the importance of this pest. On the other hand, the movement eastward of the one-generation strain may, by inter-breeding, counteract, to some extent, the tendency to multiple generations in the eastern strain. Work on *Platyedra gossypiella* included experiments on the effect of low temperatures on the larvae. Exposed larvae were not injured at 15° F., but some were killed by four hours' exposure at 10° F., and almost all at 5° F. after one hour's exposure. Larvae in double seeds

showed some mortality at 10° F. for four hours, and all were killed after four hours at 5° F. or two hours at 0° F. From June 1927 to April 1929 *Anastrepha ludens* was not found in the Rio Grande Valley of Texas, but in the spring of 1929 it was rediscovered in stored fruit in Hidalgo County, after the citrus crop had been harvested and most of it shipped. It is believed that the new infestation has been eliminated. Extending the time for the harvesting of the crop in 1928–29 at the urgent request of the growers is now believed to have been a mistake, and such extension is clearly inadvisable in the future.

A list of injurious insects intercepted during the year includes *Polychrosis botrana*, Schiff., in grapes from Italy, *Cylas formicarius*, F. (*turcipennis*, Schönh.) in sweet potatoes from Japan, and *Eumerus strigatus*, Fall., in onions from Canada, Holland and Spain.

Craighead (F. C.). **Interrelation of Tree-killing Barkbeetles** (*Dendroctonus*) **and Blue Stains.**—*J. Forestry*, xxvi, no. 7, pp. 886–887, 4 refs. Washington, D.C., November 1928.

Beetles of the genus *Dendroctonus* are the most important pests of coniferous forests in the United States and annually destroy large quantities of timber. The theory that the death of healthy trees is the result of the complete girdling of the cambium and phloem by means of the egg tunnels of the adults and the mines made by the larvae appears inadequate, for trees infested by the summer generations of some species of *Dendroctonus* may show fading foliage within three weeks after attack, whereas trees mechanically girdled by removing bark from portions or from the entire main stem may live from six months to a year or more and continue to add annual layers of wood on those portions above the girdle. It is therefore suggested that the fungus (*Ceratostomella* sp.) causing "blue stains," which is almost invariably associated with attacks by these beetles, may be introduced by them under the bark and may play an important part in the death of the trees. Observations indicate that the trees are killed by the interruption of the stream of ascending sap, and this might possibly be caused by the action of some toxic secretion of the fungi destroying the living ray tissue of the stem or affecting the normal function of the leaves in transpiration, or by the clogging of the tracheids by the rapidly developing hyphae. Moreover, it is thought that the fungi may produce the conditions necessary for the normal development of the progeny of the bark-beetles, both by affecting the physical environment and possibly by supplying essential food requirements. After attack, the moisture content of the upper parts of the tree gradually decreases, whereas in the part below the lower limit of infestation it increases, and treatments aimed at increasing the moisture content of the stem (by defoliation or by supplying ample water to the roots) tend to check the development of the fungi and the beetles.

Nelson (R. M.) & Beal (J. A.). **Experiments with Bluestain Fungi in Southern Pines.**—*Phytopathology*, xix, no. 12, pp. 1101–1106, 6 refs. Lancaster, Pa., December 1929.

The occurrence of the fungus (*Ceratostomella*) causing bluestain in pines in the southern United States is uncommon except in association with bark-beetle attack. In an unpublished paper, R. H. Colley and H. Peirson report that only 4 per cent. of 234 zones of bluestain occurring

in western yellow pines (*Pinus ponderosa*) did not appear to have originated in the entrance holes of *Dendroctonus brevicomis*, Lec. (western pine beetle), and the authors found that 97 per cent. of 218 zones occurring in shortleaf pine (*P. echinata*) were directly associated with the entrance holes of *D. frontalis*, Zimm. (southern pine beetle). It is therefore suggested that the beetles carry the fungi into their tunnels and in this way inoculate the trees [see preceding paper]. Experiments were carried out in order to determine whether the fungus was capable of destroying the trees when not associated with beetle attack. Fungi were isolated from trees attacked by *D. frontalis*, *D. terebrans*, Oliv. (black turpentine beetle) and *Ips calligraphus*, Germ., and from the adult beetles (in some cases fungi were obtained from beetles in newly made tunnels showing no stain), cultured and inoculated by various methods into shortleaf pines and pitch pines (*P. rigida*). In culture the fungi associated with each of the three species of beetles can be readily distinguished. It was found that the fungi together with the wounding that accompanies inoculation may kill pines in a comparatively short time. The fact that trees attacked by beetles and the accompanying fungi die more rapidly than mechanically injured trees is confirmed [*loc. cit.*], and the authors agree with the suggestion that the bluestain fungi may play an important part in the death of pines attacked by *D. frontalis*.

Binkley (A. M.). **Transmission Studies with the new Psyllid-Yellows Disease of solanaceous Plants.**—*Science*, lxx, no. 1825, p. 615. New York, N.Y., 20th December 1929.

An apparently new disease of potato and other solanaceous plants, the characteristic symptom of which is the upward cupping of the leaves and dwarfing of the plants, was extremely destructive in Colorado in 1926–28 and was believed to be associated with the Psyllid, *Paratrioza cockerelli*, Sulc [*cf. R.A.E.*, A, xvii, 281]. Nymphs hatching from eggs laid by infective Psyllids and allowed to feed on healthy tomato plants until they became adult did not produce the disease, which is not, therefore, transmitted through the egg, but nymphs transferred from diseased to healthy potato plants produced the symptoms in 7–10 days. It has also been transmitted from diseased tomato to healthy potato plants, and *vice versa*, and also to the common garden pepper [*Capsicum*], egg-plant [*Solanum melongena*] and the ornamental Jerusalem cherry [*S. pseudocapsicum*]. The disease is very destructive and the Psyllid is difficult to control, owing to its habit of feeding on the lower surface of the leaves and the strength of the spray necessary to kill it.

Dobroscky (I. D.). **Cranberry False-blossom Disease spread by a Leafhopper.**—*Science*, lxx, no. 1826, p. 635, 1 ref. New York, N.Y., 27th December 1929.

Following observations made during 1924–26 [*R.A.E.*, A, xvii, 30] suggesting the agency of *Euscelis striatulus*, Fall., in the spread of false-blossom of cranberry in the United States, leafhoppers were transferred from diseased seedlings to healthy ones, and allowed to feed for about 2 weeks, numerous seedlings becoming affected. Under favourable conditions, the first symptoms appear about a month after the plants are exposed to infective leafhoppers. The disease is

recognised in its early stages by small leaves, by an upright habit of growth and by the production of an abnormally large number of secondary shoots. It is not known whether *E. striatulus* is the only insect that spreads the disease, but several other cranberry insects tested failed to transmit it.

STEINER (G.). *Neoaplectana glaseri*, **n.g., n. sp. (Oxyuridae), a new nemic Parasite of the Japanese Beetle** (*Popillia japonica* **Newm.**).—*J. Wash. Acad. Sci.*, xix, no. 19, pp. 436–440, 1 fig., 5 refs. Baltimore, Md., 19th November 1929.

GLASER (R. W.) & FOX (H.). **A Nematode Parasite of the Japanese Beetle** (*Popillia japonica*, **Newm.**).—*Science*, lxxi, no. 1827, pp. 16–17, 1 ref. New York, N.Y., 3rd January 1930.

Neoaplectana glaseri, gen. et sp. n., described in the first paper, is recorded in the second as being found in numerous larvae, two pupae and two adults of *Popillia japonica*, Newm., in a district of New Jersey in May and June. Of 16 larvae exposed to infection by the Nematodes in soil, 15 were killed by them in 5–7 days, a similar result being obtained when the experiment was repeated a month later. Since the host spends most of its life-cycle in the ground, which is the natural environment of the Nematode during at least part of its existence, and since the latter possesses a high reproductive capacity, it might prove of great value in the control of the beetle, if distributed where the latter occurs.

THOMAS (C. A.). **The Parasites of Wireworms (Coleop.: Elateridae).**—*Ent. News*, xl, no. 9, pp. 287–293, 1 fig., 31 refs. Philadelphia, Pa., November 1929.

The literature on the parasites of wireworms in Europe, South America and the United States is briefly reviewed. Although many wireworms have been bred, few parasites have been recorded. In 1924 the author found a cocoon of the Bethylid, *Pristocera armifera*, Say, attached to the empty skin of a larva of *Melanotus* sp. in New Jersey.

CARPENTER (I. P.). **Study of the Life History and Spotting Habits of** *Eutettix chenopodii* **(Homoptera, Cicadellidae).**—*Kansas Univ. Sci. Bull.*, xviii, no. 7, pp. 457–483, 1 pl., 8 refs. Lawrence, Kans., April 1928.

A detailed account is given of the bionomics of *Eutettix chenopodii*, Osborn (*strobi*, Fitch) from insectary observations made in Kansas during 1926. The normal food-plant of this leafhopper is *Chenopodium album*, but it can breed on other weeds and on beet. The spotting caused by the feeding of the nymphs on the leaves of the food-plants is discussed [*cf. R.A.E.*, A, xiv, 293].

BROOKS (F. E.) & COTTON (R. T.). **The Chestnut Curculios.**—*Tech. Bull. U.S. Dept. Agric.*, no. 130, 23 pp., 6 pls. Washington, D.C., August 1929.

Three species of sweet chestnut are grown in North America, namely, *Castanea dentata*, *C. pumila* and *C. alnifolia*. All produce nuts of

more or less value, which, however, are frequently rendered almost worthless by *Curculio proboscideus*, F. (larger chestnut curculio) and *C. auriger*, Casey (lesser chestnut curculio). Both these weevils are found in practically all regions of the United States and Canada where the nuts are grown, and they sometimes damage 50–100 per cent. of the crop. Many nuts that appear sound when harvested contain eggs that subsequently hatch ; an infested nut usually harbours several grubs. Recently introduced species of *Castanea* also appear liable to attack.

The life-cycle of *C. proboscideus* occupies one year, a few individuals requiring two. The adults appear on the trees when the burs are nearly full-grown and oviposit into the nuts through their spiny covering. The larvae hatch in about 10 days and feed within the nuts for 6–10 weeks, this period apparently being prolonged if the kernel becomes dry. When full-grown, by which time the nut has usually fallen, they enter the ground, where they construct cells a few inches below the surface and remain through the winter. In the following summer, about 1st July, they pupate within the cell, and after 4 or 5 weeks the adults emerge. They remain on the trees and continue oviposition until the burs are full-grown, but their numbers decrease as the nuts become mature and by the time the latter begin to drop practically all have disappeared. One beetle may lay from 25 to 50 eggs.

The life-cycle of *C. auriger* occupies two years, but 5–10 per cent. of the insects require three. The beetles emerge from the ground in spring before the trees bloom, remaining largely inactive on the branches, but when the nuts begin to ripen they collect on the burs, where pairing and oviposition take place. The larvae enter the ground in late autumn, spend the winter and following summer in their earthern cells, and pupate and transform to adults in autumn. The latter remain in the cells until spring. The stages and habits of the adults of both these species are described, with technical descriptions of the mature larva of each. Natural enemies include squirrels, shrews, various birds, spiders and ants. Two Tachinids, *Winthemia quadripustulata*, F., and *Myiophasia aenea*, Wied. (*nigrifrons*, Tns.), were reared from the larvae in West Virginia, the former from *C. proboscideus* and the latter from both species. The Braconid, *Urosigalphus armatus*, Ashm., is in some districts an important check on their numbers. The adult deposits an egg within or near that of the weevil, and the parasite larva matures within the host and does not kill it until just before it pupates in the ground. It then itself pupates within the cell of the host, the adult emerging shortly afterwards.

Artificial control of the weevils is difficult, as though some of the adults may be killed by arsenical sprays, they usually feed below the surface to which the spray is applied. Extreme heat or cold will kill the larvae within the nuts, but only at temperatures injurious to the latter. Scalding the nuts in water at 120° F. for 30 to 45 minutes and then immediately drying them is commonly practised, but must be carefully done or the quality of the nuts will deteriorate. Fumigation with carbon bisulphide, 1 oz. to 60 lb. of nuts, for 15 or 16 hours and afterwards spreading them out to air is successful, if the container is tightly closed. Any larvae emerging from gathered nuts should be destroyed. Adults may be collected by jarring them from the trees on to sheets spread below ; this should be done repeatedly while the trees

are in bloom and when the burs are nearly full-grown. It is doubtful, however, whether sufficient benefit can be obtained from either this method or spraying to justify the labour and expense. Auxiliary remedies are destruction of the insects in the soil by cultivation, the use of soil fumigants, turning pigs into the orchards after the crop is gathered, and cleaning up and destroying all crop remnants.

Some 50 other species of *Curculio* attack nuts and acorns in North America, the most important in the United States being *C. caryae*, Horn, on hickory and pecan, and *C. obtusus*, Blanch., on *Corylus americana* and *C. rostrata*.

SNYDER (T. E.). **Termites in Buildings.**—*Leafl. U.S. Dept. Agric.*, no. 31, 5 pp., 2 figs., 1 ref. [Washington, D.C.] June 1929.

In addition to information already noticed [*R.A.E.*, A, xiv, 409; xvii, 730, etc.] concerning the prevention of damage caused by termites in buildings, a number of regulations, suitable for incorporation in city building codes, are suggested. Untreated wood or fibre products should not be placed within 18 inches of the earth, excepting wood posts over a concrete floor, which should be provided with non-corroding metal or concrete base plates or footings 6 inches above the floor. Timber to be used in contact with the earth should be thoroughly impregnated with a satisfactory preservative after being cut to proper dimensions. Masonry foundations should be laid in Portland cement mortar and those built up of masonry units capped with an efficient seal such as slate or non-corroding metal. A shield should be provided in the case of frame buildings [xvii, 730] and should consist of non-corroding metal, such as copper, zinc, or an alloy composed of 28 per cent. copper, 67 per cent. nickel and 5 per cent. iron, manganese and silicon. Floor sleepers or joists embedded in masonry or concrete should be impregnated. Expansion joints between concrete floor and wall should be filled with liquid asphaltum and the right-angle joint covered with a sanitary cement mortar. The ends of beams entering masonry or concrete should be provided with boxes affording an air space not less than 1 inch wide, unless they are impregnated. Spaces under the floor near the earth should be excavated to a depth of 18 inches from the wood and provided with cross-ventilation, all the openings being covered with 20-mesh non-corroding metal screening. Where timber is used on flat roofs, the roof should have a sufficient slope to provide proper drainage. All wooden forms should be removed from masonry work within 15 days, and grading stakes should be removed before laying concrete floors.

HUCKETT (H. C.). **Cucumber Beetles.**—*Circ. New York State Agric. Expt. Sta.*, no. 113, 8 pp., 7 figs. Geneva, N.Y., May 1929.

Cucurbits grown in New York generally require protection during the first month or six weeks of growth from the cucumber beetles, *Diabrotica vittata*, F., and *D. duodecimpunctata*, F. The best methods are hand spraying and hand dusting, renewed applications being required in wet weather. For the spray, 3 lb. calcium arsenate and 3 lb. casein-lime in 50 U.S. gals. water is recommended, but a dust composed of 1 lb. calcium arsenate with 15 lb. gypsum or hydrated lime is preferred

as being cheaper and quicker to apply, though rather more harmful to plant growth. All parts of the plants should be covered, especially round the base of the stems and at the tender shoots. These insecticides merely serve to drive the beetles from the plants; their destruction is very difficult because they are so easily disturbed and because of their habit of sheltering in the soil or under leaves. An attempt was made to kill them by planting rows of squash seedlings among the cucurbits. About 80 squash hills were used on two acres, and were treated by a flame from a blow torch the day after the main crop was sprayed or dusted. Very few seedlings were injured, and large numbers of beetles were immediately destroyed. The trap plants should be kept small by occasional resowings and thinnings. The results showed that the beetles are very numerous on them provided that the main crop is thoroughly and regularly treated. As soon as the latter begins to blossom or if it has been untreated, there is little advantage to be gained from trap plants.

Cushman (R. A.). **New Species of Ichneumon-flies and Taxonomic Notes.**—*Proc. U.S. Nat. Mus.*, lxxvi, art. 25, no. 2822, 18 pp. Washington, D.C., 6th January 1930.

Among the Ichneumonids discussed are *Amblyteles* (*Ichneumon*) *velox*, Cress. (*I. puerilis*, Cress.), examples of which were reared from the hemlock looper [*Ellopia fiscellaria*, Gn.] in Ontario in September 1928; *Rhembobius* (*Phygadeuon*) *abdominalis*, Prov., from the bulb flies, *Merodon equestris*, F., and *Eumerus strigatus*, Fall., in Washington and California respectively; *Chromocryptus mesorufus*, sp. n., said to have been reared from a Trypetid, *Anastrepha ludens*, Lw., or *A. striata*, Schin., in Mexico; *Cremastus* (*Cremastidea*) *chinensis*, Vier., reared from *Chilo simplex*, Butl., in Japan; *C. gracilipes*, Cushm., including a record of it from *Cydia* (*Laspeyresia*) *molesta*, Busck, in New Jersey; *C. carpocapsae*, sp. n., from *Cydia* (*Carpocapsa*) *pomonella*, L., in Ohio; and *C. rhyacioniae*, sp. n., and *Pristomerus baumhoferi*, sp. n., from *Rhyacionia frustrana* var. *bushnelli*, Busck, in S. Dakota and Nebraska respectively.

Grossman (E. F.). **Biology of the Mexican Cotton Boll Weevil. IV. Duration of Fertility after Copulation.**—*Florida Ent.*, xiii, no. 3, pp. 41–43. Gainesville, Fla., September 1929.

Females of *Anthonomus grandis*, Boh. (cotton boll weevil) were isolated after mating and kept for various periods in artificial hibernating quarters at a temperature of 55° F. They were then placed on fresh cotton squares in an incubator at 80° F. Fertile eggs were laid after periods up to almost seven months after mating had occurred.

Bratley (H. E.). **Notes on *Lymire edwardsii* Grote, the Rubber Tree Caterpillar.**—*Florida Ent.*, xiii, no. 3, p. 44. Gainesville, Fla., September 1929.

The Syntomid, *Lymire edwardsi*, Grote, appears to be widely distributed in the semi-tropical area of Florida where its food-plant,

a rubber tree (*Ficus* sp.), occurs. It is parasitised by the Chalcid, *Brachymeria robusta*, Cress., and the Tachinid, *Phorocera claripennis*, Macq. ; the rate of parasitism may be sometimes as high as 96 per cent.

HAMILTON (C. C.). **The Mexican Bean Beetle and how to control it.**—*Circ. New Jersey Agric. Expt. Sta.*, no. 216, 16 pp., 10 figs., 5 refs. New Brunswick, N.J., March 1929.

Epilachna corrupta, Muls., caused some damage to beans in various parts of New Jersey during 1927 and 1928 ; in one county the plantings were completely destroyed in the latter year. Three generations probably occur during the year in the southern part of the State. A brief account is given of the bionomics of this beetle, with recommendations for its control [*R.A.E.*, A, xvii, 618, etc.] ; and various types of spraying and dusting equipment are discussed and figured. Climate is an important factor in relation to *E. corrupta* ; large numbers of all stages are killed during very hot and dry weather.

BALDUF (W. V.). **Bionomic Notes on some Parasites of** *Achatodes zeae* **Harris (Noctuidae, Lep.) and** *Phlyctaenia tertialis* **(Guen.) (Pyralidae, Lep.).**—*Ohio J.Sci.*, xxix, no. 5, pp. 218–242, 21 refs. Columbus, Ohio, September 1929.

The notes given are based mainly on personal observations made in the course of work in Ohio and Illinois in 1927 and 1928 on the parasites of *Achatodes zeae*, Harr., and *Phlyctaenia tertialis*, Gn., infesting elder. The larvae of *A. zeae* were attacked by *Microbracon lutus*, Prov., *Pimpla* (*Epiurus*) *pterophori*, Ashm., and the Eulophid, *Miotropis clisiocampae*, Ashm., and *Amblyteles* sp. was bred from the pupae. The Braconid, *Microplitis gortynae*, Riley, attacked the larvae of both *A. zeae* and *Papaipema nitela*, Gn. The diseased larvae of *A. zeae* were consumed by the Phorid, *Megaselia* (*Aphiochaeta*) *aletiae*, Comst., a scavenger [*cf. R.A.E.*, A, xvii, 85]. Two females of *Eurytoma* sp. were taken alive in a cage of *A. zeae*, and the Pteromalid, *Habrocytus* sp., occurred in cages containing the pupae of *A. zeae* and the cocoons of *M. gortynae*.

The larvae of *P. tertialis* were attacked by the Braconid, *Meteorus loxostegei*, Viereck, the Ichneumonids, *Hoplocryptus* spp., *Eulimneria* sp., and *Aenoplex nigrosoma*, Cushm. (doubtfully determined), the Tachinid, *Zenillia caesar*, Aldrich, and probably by the Braconids, *Apanteles* sp. and *Bassus simillimus*, Cress., and the Ichneumonids, *Phytodietus pulcherrimus*, Cress., *P. distinctus*, Cress., *Triclistus propinquus*, Cress., *Sesioplex validus*, Cress., and *Gambrus incertus*, Cress. The pupae were attacked by the Tachinid, *Nemorilla floralis*, Fall. Secondary parasites observed included *Eupteromalus viridescens*, Walsh, in the cocoons of *M. gortynae* and *M. lutus*, and the Elasmid, *Elasmus atratus*, How., probably attacking *Apanteles* sp. *Gelis* sp. occurred in cages containing the cocoons of *Apanteles* sp. and other primary parasites of *P. tertialis*.

One or more individuals of most of the above species developed under the direct observation of the author, and the remainder are concluded to be the parasites of the moths concerned, since no other insects were present in sufficient numbers to have been their hosts.

The Chloropid, *Gaurax dorsalis*, Lw., was bred from cages containing larvae and pupae of *P. tertialis*, on the remains of which, and of other insects attacking elder, it is probably a scavenger.

RUHMANN (M. H.). **Report of Assistant Entomologist, Vernon.**—*23rd Ann. Rep. Brit. Columbia Dept. Agric. 1928*, pp. 40–42. Victoria, B.C., 1929.

Almost all the pests dealt with in this report are recorded in one of the papers noticed in the next abstract. The larvae of the Melolonthid, *Polyphylla decemlineata*, Say, caused much damage to young fruit trees, small fruits and garden crops.

[**Insects of the Season 1928 in Canada.**]—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 7–38, 1 ref. Toronto, 1929.

Notes by various authors are given on the insect pests observed in different parts of Canada in 1928. W. H. Brittain considers that the real feature of the season in Nova Scotia, so far as orchard pests are concerned, was the sudden and uniform increase of infestation by *Lygus communis*, Knight (green apple bug). The injury caused was intensified by the fact that the set of fruit was light. As this Capsid had not been numerous since 1920, it is suggested that it was controlled by *Empusa erupta*; the fungus apparently rarely becomes effective until the insects are present in large numbers. The adults show a preference for pears and will also attack plums, whereas the nymphs only occasionally occur on the former and are never found on the latter. *L. communis* has been recorded during the past season as damaging rose blossoms and hollyhocks. Heavy dusting with 4 per cent. nicotine put an end to the infestation.

F. C. Gilliatt reports that as a result of yearly collection of the winter webs of *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, auct.) since its first discovery in Nova Scotia in 1907, this moth appears to have been eradicated. *Tetranychus flavus*, Ewing, which is considered a pest of major importance in the United States, was found in large numbers on apple foliage in one locality. It is stated that the moth recorded on apple as *Hemerophila* (*Allononyma*) *vicarialis*, Zell. [*R.A.E.*, A, xvii, 92] was actually *H.* (*Simaëthis*) *pariana*, Cl.

Insect pests occurring in New Brunswick are discussed by R. P. Gorham, G. P. Walker and L. J. Simpson. Amongst those of special interest are *Crambus ruricolellus*, Zell., recorded for the first time as causing injury to maize seedlings. *Cryptococcus fagi*, Bär., which was first discovered in New Brunswick in 1927, is now present in most of the beech-growing areas of two counties. This Coccid has killed a large percentage of beeches in Nova Scotia.

W. A. Ross and L. Caesar record the occurrence in several counties in Ontario of *Tarsonemus pallidus*, Banks (cyclamen mite) on strawberries, causing dwarfing and crinkling of the leaves. It is thought that the high humidity of the preceding summer was favourable to it.

A. V. Mitchener and N. Criddle report that *Disonycha davisi*, Schaeffer, which originally infested wild sand cherry (*Prunus pumila*), has now been found attacking cultivated plum and cherry in Manitoba.

Barathra configurata, Wlk. (bertha army worm) is mentioned by H. L. Seamans as having caused serious damage to lucerne, sweet

clover, cabbages and potatoes in Alberta ; it does not attack wheat or oats.

E. Hearle states that in British Columbia outbreaks of *Ellopia somniaria*, Hulst., the first since 1916, have occurred in two localities. Western hemlock [*Tsuga heterophylla*] was defoliated, and other conifers, as well as maple and alder, were also attacked.

BAIRD (A. B.). **The present Status of Corn Borer Parasites in Canada.** —*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 38–40. Toronto, 1929.

Native parasites have been found to be of negligible value in the control of the European corn borer [*Pyrausta nubilalis*, Hb.] in Ontario. Those reared include occasional individuals of *Microbracon* (*Habrobracon*) sp., *M. gelechiae*, Ashm. (*H. tetralophae*, Vier.) and *M. mellitor*, Say, from the immature larvae, the Tachinids, *Phorocera erecta*, Coq., and *Ceromasia* (*Erycia*) *myoidaea*, Desv., from mature larvae, and the Ichneumonid, *Labrorychus prismaticus*, Nort., from the pupae. The egg parasite, *Trichogramma minutum*, Riley, was quite abundant in 1924 and 1925, but appeared too late in the season to have any appreciable effect. A few individuals of the Tachinid, *Zenillia caesar*, Aldr., have been reared every season from mature larvae taken from the field in late autumn and early spring, but in no case did the parasitism reach 1 per cent.

Of the parasites introduced from Europe into Canada in co-operation with the United States Bureau of Entomology, the numbers liberated in the field up to 31st October 1928 were 3,274,500 individuals of *Microbracon brevicornis*, Wesm., 185,050 of *Pimpla* (*Exeristes*) *roborator*, F., 58,558 of *Microgaster tibialis*, Nees, 2,417 of *Apanteles thompsoni*, Lyle, 10,187 of *Eulimneria alkae*, Elb. & Sacht. (*crassifemur*, auct.) and 19,138 of *Macrocentrus gifuensis*, Ashm. *Microgaster*, *Pimpla* and *Macrocentrus* have been recovered from maize stalks left in the field during the winter. Several experiments in utilising *T. minutum* for controlling *P. nubilalis* were conducted in 1928, and some 46,000 adults were released.

STIRRETT (G. M.). **Notes on the Life-history of the European Corn Borer in Ontario.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 40–43, 1 ref. Toronto, 1929.

Notes are given on the biology of *Pyrausta nubilalis*, Hb. (European corn borer) in Ontario during 1927 and 1928. The seasonal history differed very little in the two years. The winter mortality of the larvae in maize stalks and stubble was 6·5 per cent. in both years. Pupation began during the first week in June and lasted until the middle of July. The adults emerge during the last week in June and throughout all July. No moths were present in the field when the temperature dropped below 58° F. They were most abundant between 9 and 9.15 p.m. In 1928 a small secondary flight was observed on 17th July between 2.15 and 4.10 a.m. ; it is probable that such a flight occurs on any favourable morning. Oviposition continued throughout July and the first 8–10 days in August, and the eggs hatched in 3–9 days. Of 1,082 eggs deposited on maize in an experimental plot, 1,051 hatched, and 444 larvae became established in the plants. The mortality of the larvae of the early instars (57·76 per cent.) was therefore much lower than in previous years [*R.A.E.*, A, xv, 666].

Marston (A. R.). **Corn Investigations in Relation to the European Corn Borer.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 43–45. Toronto, 1929.

This is an account of plant-breeding experiments with maize begun in Michigan in 1926, in an attempt to obtain an early maturing strain resistant to the European corn borer [*Pyrausta nubilalis*, Hb.]. Among two lots of hybrids in the second generation, produced by crossing an early maturing non-resistant variety and a late maturing resistant one, an infestation of 8 and 18 per cent. occurred in 1928, whereas the infestation in adjacent rows containing the two parent plants was 68 and 5 per cent. respectively.

Thompson (R. W.). **The Percentage and Number of European Corn Borers wintering in the Parts of Corn Stalks below the Surface of the Ground.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 46–49. Toronto, 1929.

Since the cultural methods in Kent and Essex counties in Ontario are such that if possible some method of clean up against the European corn borer [*Pyrausta nubilalis*, Hb.] other than ploughing is desirable, clause 5 of the Regulations under the Corn Borer Act [*R.A.E.*, A, xvii, 394] has been provisionally altered as follows: "Corn [maize] shall be cut level with the ground and all remnants gathered and burnt, or if cut higher, the stubble shall be ploughed under completely, and if any of it is dragged up later when cultivating it shall be gathered and burnt within 10 days."

Investigations were conducted in various fields in 1928 to determine the percentage of the larvae hibernating in maize stubble below the surface of the ground. The percentages in 4 fields varied from 0·36 to 5·5. In the discussion that followed, D. J. Caffrey remarked that in 1927 in a badly infested field in which the total population of larvae was estimated at 262,750, less than 1 per cent. of them were found below the surface. The number would depend upon the condition of the stalks, since the larvae tend to leave the upper and dry parts for the lower and more moist ones as the season advances.

Caesar (L.). **Corn Borer Situation in Ontario in 1928.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 49–52. Toronto, 1929.

The distribution of *Pyrausta nubilalis*, Hb. (European corn borer) in Ontario is briefly discussed. By the autumn of 1928, 20 counties and parts of four more had been brought under the Corn Borer Act [*R.A.E.*, A, xvii, 394]. In 1927, a reduction of infestation in five out of the first eight counties to come under the Act [xvii, 93] was observed.

Infestation in six counties, where damage was exceptionally severe in that year, has been reduced by 33 per cent. As the actual number of larvae to each stalk decreases more rapidly than the percentage of stalk infestation, this would mean a considerably larger decrease in the total number of borers. In Norfolk County, however, in spite of cultural control measures, infestation has increased by at least 50 per cent. Most of the maize in this county is sown early and is of the sweet variety, and since the moths are attracted to early maize it

is thought probable that they migrated from the adjacent counties. Moreover, a higher percentage of larvae matures in sweet maize than in ordinary field varieties.

Steenburgh (W. E.). **The Laboratory Breeding of** *Microgaster tibialis* **Nees.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 55–57. Toronto, 1929.

The artificial propagation of the Braconid, *Microgaster tibialis*, Nees, for controlling *Pyrausta nubilalis*, Hb. (European corn borer) in Canada was initiated in March 1927. In the field the parasites attack larvae of the second and third instars, a single egg being laid in each. The parasite larva develops within the body cavity of its host, and on reaching maturity spins a cocoon beside the remains of the dead larva, where it hibernates, emerging as an adult in the following spring.

The technique of breeding hosts for parasitism has already been noticed [*R.A.E.*, A, xvii, 394]. The cages used for obtaining oviposition of *M. tibialis* are of wood, 8 ins. high and 6 ins. wide, and fitted with a double front of waxed cheesecloth and glass. The back is left open when in use but can be closed with a screen when necessary. The glass front of the cage is placed towards the light, and the waxed cheesecloth prevents the light from being too intense and diffuses it evenly. Since both the parasites and their host are positively phototropic it is possible, by reducing the lighted area, to concentrate them, thus making it easier for the parasites to find the larvae. The best results were obtained with 8 females and not more than 4 larvae placed with them at a time. The longevity of the adult parasites in the cages was from 8 to 12 days and varied with the temperature, the amount of light and number of eggs they laid. When not in use the parasites should be kept at a low temperature and in subdued light.

The parasitised larvae are isolated in vials [xvii, 364], and the parasites require 11–16 days to develop within their host. As soon as the cocoons are formed, they are placed in a container consisting of two flower pot saucers, one inverted over the other. The saucers are soaked in water for several hours before being used. A high humidity is essential for the development of the parasites, and moisture when needed is added to the outer surface of the top saucer. The females used for breeding should be mated, since unfertilised females produce males only. As a result of two years' laboratory breeding, 2,000 adults have been liberated in the field.

Seamans (H. L.). **The Value of Trap Crops in the Control of the Wheat Stem Sawfly in Alberta.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 59–64. Toronto, 1929.

Cephus cinctus, Nort. (wheat-stem sawfly) has been gradually spreading through Alberta for the last 10 years and is now well established in the south-central part of the Province. The loss it caused was very severe in 1925 and 1926, but was reduced by the wet seasons of 1927 and 1928. Its control in this area by cultural methods is impracticable, as the heavy, moist soil only allows of the use of a disk plough, which does not bury the stubble containing the larvae. Investigations were therefore conducted to test the value

of various grasses and crops as trap plants. The date of emergence of the adult sawflies is dependent on weather conditions ; in 1926 they first appeared on 22nd May, and in 1927 a month later. Oviposition begins a day or two after emergence. Grasses or cereals that have stems that are hollow though still succulent and have formed a head are invariably chosen, and several eggs may be laid in one stem. The first larva to hatch destroys the remaining eggs. Plants that become suitable for oviposition earlier than the main crop of wheat and therefore receive the bulk of the eggs should be used. These include *Bromus inermis*, *Agropyrum smithi*, winter wheat, winter rye and self-sown spring wheat. Very few larvae are able to mature in *Bromus* or oats, and these can be grown for hay or seed. If, however, spring wheat or other grasses are used, they should be cut before the larvae have descended to the base of the stem, as otherwise a large number will mature in the stubble. *Bromus* is perhaps the best trap plant, since it is the first to produce a head in spring, and if sown along a roadside or fence will control noxious weeds. One sowing will establish it for several years. As, however, it requires a season's growth before it is vigorous enough to be effective, it should be sown with oats as a nurse crop, the oats acting as a trap for the first season. Since most of the wheat is sown on fallow land, it is attacked by sawflies from the outside, and a trap strip 11–16 yards wide along the edges of the field will probably give sufficient protection to a field of 100 acres.

ARMSTRONG (T.). **Notes on the Life History of the Oriental Peach Moth at Vineland Station.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 65–72, 2 figs. Toronto, 1929.

Serious injury to peaches in Ontario has been caused by the oriental peach moth [*Cydia molesta*, Busck] since it was first discovered in this Province in 1925. Three generations occur during the year. In 1927 the overwintering larvae began to pupate about 17th March and the first adults appeared early in May, when the peach trees had a terminal shoot growth of half an inch or less and the blossom buds were still unbroken. The eggs are deposited, singly, on the leaves and shoots, and hatch in 6–10 days. The newly hatched larva does not eat the plant tissues that it removes with its mouth-parts in order to enter the twig or fruit. In spring and early summer the larvae feed in the shoots, sometimes subsequently passing on to the fruit. The fruit is usually attacked through the stem end, in which case no external injury is visible. The average feeding periods of the larvae of the three generations lasted 18·8, 20 and 40 days respectively. In summer the larvae spin their cocoons at the junctions of the twigs or on the fruit. The larvae of the third generation hibernate in cocoons in the rough bark or other sheltered places ; the mortality among them is about 50 per cent. The summer larvae pupate a few days after they cease to feed, the pupal stage lasting about a fortnight.

The moths are present in the orchard, probably with a slight break between the overwintered and first generations, from the first emergence until the late autumn. Moths from overwintered larvae may continue to emerge for two months. It is remarked that if the larvae hibernate in sheltered positions or in storage the moths emerge later. During the warm weather they are very active, particularly from noon till after sunset, but at temperatures below 60° F. they become sluggish.

They live longer in cold weather; in the insectary the average length of life of the females was 16–21 days. The maximum number of eggs laid by one female was 136.

The larvae have been reared on a variety of fruits in the insectary and have been found in quinces, apples and pears in the field. Two types of oviposition cages used during these investigations, one made of glass and the other of wire gauze, are figured. The latter was found the more satisfactory.

SMITH (C. W.). **Parasitism of the Oriental Peach Moth in Ontario with special Reference to Biological Control Experiments with** *Trichogramma minutum* **Riley.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 72–80, 5 figs. Toronto, 1929.

The Chalcid, *Trichogramma minutum*, Riley, was first discovered in 1928 parasitising the eggs of *Cydia* (*Laspeyresia*) *molesta*, Busck, in various localities in Ontario; the percentage of parasitism ranged from 1 to 25. Parasites obtained in small numbers from the larvae of this moth from 1926 to 1928 were *Ascogaster carpocapsae*, Vier., *Angitia* (*Dioctes*) *obliteratus*, Cress., *Glypta rufiscutellaris*, Cress., *G. varipes*, Cress., *Cremastus minor*, Cush., *Aenoplex betulaecola*, Ashm., *Ephialtes aequalis*, Prov., *Eubadizon pleurale*, Cress., *Macrocentrus delicatus*, Cress., *Microbracon mellitor*, Say, *Triaspis* sp., *Meteorus* sp., two species of *Pimpla* of the subgenera *Tromera* and *Epiurus*, and a Tachinid. *Pimpla* (*Itoplectis*) *conquisitor*, Say, was bred from the pupae.

Experiments in biological control with *T. minutum* were carried out in an orchard that had been a centre of infestation for some years. The method of transporting the parasites was to send paper disks 3 ins. in diameter bearing the parasitised eggs packed in cylindrical ice-cream cartons. On arrival the disks were placed individually in Petri dishes, where they remained until the adult parasites were ready to emerge. Of three methods of releasing them in the orchard, the best was to allow the parasites to escape without disturbing them and then fix the disks bearing the remaining eggs to the twigs. On dull days, when the parasites do not readily leave the dishes, they may be liberated more rapidly by tapping. Light is the most important factor influencing the activity of the adult parasites, differences in temperature (66–88° F.) having apparently little effect. The process of oviposition is described. From July to October five generations occurred in the field, the life-cycle lasting 11–33 days. The best results were obtained with liberations made when oviposition of *C. molesta* was approaching a maximum. Although a comparatively small number of individuals was released, investigations show that 40 per cent. of the eggs in the orchard were parasitised.

PETERSON (A.). **Some Remarks on the present Status of Insecticidal and Biological Control Investigations for the Oriental Peach Moth,** *Laspeyresia molesta* **Busck.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 80–86. Toronto, 1929.

The first part of this paper is a review of the possibilities of controlling *Cydia molesta*, Busck, by insecticides and other artificial measures [*R.A.E.*, A, xvii, 372]. The second part is an account of the observations of various workers in the United States on the natural control

of this pest by means of fungi, several species of which destroy the hibernating larvae, and parasitic Hymenoptera, the most important of which are *Trichogramma minutum*, Riley, *Macrocentrus ancylivora*, Rohw., and *Glypta rufiscutellaris*, Cress. [xvii, 272, 388].

GARLICK (W. G.). **Notes on the Red Spider on Bush Fruits.** *T. telarius* **L.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 86–93. Toronto, 1929.

This is an account of investigations conducted in 1927 and 1928 on the life-history of *Tetranychus telarius*, L., on black currant and raspberry in Ontario. The immature stages, male, and summer and overwintering females are described. The eggs hatched in 3–32 days, and the lengths of the other stages varied with the temperature, development requiring 4–29 days. The periods spent in the various stages were: larva, 28 hours–10 days; protonymph, 1–7 days; and deutonymph, 1–12 days. Each of these stages includes an active and a quiescent period. Males were produced by both mated and unmated females. Observations indicate that males do not survive the winter. The preoviposition period lasted 1–6 days and the egg-laying period from 3 to 70, the average number of eggs laid being 90. There are probably more than 6 generations a year. Overwintering females matured in September and October, but individuals of the summer generation and eggs were still present on the plants when the foliage was killed by the frost. Overwintering mites did not oviposit till spring.

The nature of the damage caused to raspberries and black currants is described; complete defoliation may occur. Raspberries are usually attacked 10–14 days before the fruit is picked, and all the crop is sometimes lost. Outbreaks follow hot weather without heavy rain. Black currants are usually attacked shortly before the fruit is picked, and although the immediate crop may not be injured to any great extent, that of the following season may be considerably affected.

Natural enemies of *T. telarius* include:—a mite, *Seius* sp., probably *S. pomi*, Parrott, which usually preys upon the immature stages, including the eggs; the larvae of the Cecidomyiid, *Feltiella venatoria*, Felt.; *Triphleps* sp.; and a beetle, probably *Stethorus punctum*, Lec. Syrphid larvae have also been occasionally found among the mites.

Good results in control were obtained with lime-sulphur, 1 : 40, but this insecticide is injurious to raspberry. Derris or fish-oil soap used singly or together proved of little value. A spray of 1 per cent. Volck containing 1 lb. soap to 40 gals. killed all the mites, including the eggs, and usually caused no injury to raspberries, whereas the foliage was affected by a 1 per cent. raw cod oil emulsion, which also proved very effective against the mites.

CAESAR (L.). **The Apple Maggot Outbreak of 1926 to 1928.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 93–95. Toronto, 1929.

Rhagoletis pomonella, Walsh, has been present for many years in all the principal apple-growing districts of Ontario, but has only caused damage in restricted areas until recently. Orchards that had received a calyx spray for the codling moth [*Cydia pomonella*, L.] were never severely infested, since sufficient poison remained on the foliage and fruit to kill most of the flies before oviposition, which does not begin

till nearly a week after they emerge. The first general outbreak, however, occurred in 1926 and still continues. The adults emerge over a period of about 6 weeks or more and are thus largely able to escape destruction from unfavourable weather conditions. As the eggs and larvae occur within the fruit and pupation takes place in the soil, the early stages are protected from natural enemies and adverse weather conditions.

Severe damage in a number of counties was caused in 1926, but in 1927 and 1928 the infestation was successfully controlled in orchards where special spraying was carried out. In unsprayed orchards, however, the fly was still very abundant, and in one locality in 1927 the complete crop was destroyed. The author considers that the outbreaks were due to wet weather during the years under review. The moist, soft soil favoured the pupating larvae and emerging adults, and the abundance of Aphid honey-dew and moisture on which the flies feed enabled them to live longer and lay more eggs. Frequent rains soon washed off the deposits resulting from the calyx spray, and owing to the cool weather the flies appeared later than usual after its application. Spraying with lead arsenate when the flies began to appear and again lightly two weeks later, however, gave almost complete control.

Hall (J. A.). **Six Years' Study of the Life History and Habits of the Codling Moth** (*Carpocapsa pomonella* **L.**).—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 96–105. Toronto, 1929.

This paper gives the results of detailed studies in Ontario from 1923 to 1928.

Cydia (*Carpocapsa*) *pomonella*, L., has only a partial second generation in this Province, about 88 per cent. of the larvae of the first generation hibernating. In the insectary some of the hibernating larvae remained in their cocoons for two winters. The overwintered larvae begin to pupate about the end of April, or a little before the tips of the leaf-buds of apple show green ; most of them pupate at the end of May (between the cluster bud stage and the closing of the calyces), and the last when the apples average about 1½ ins. in diameter. The average length of the pupal stage is 29·5 days, the first adults appearing soon after the apples come into full bloom. Most of them emerge about a week after the calyces close, and emergence is finished about the end of July.

The preoviposition period averages 3·7 days and the oviposition period 5·3, the average number of eggs laid in the insectary being 64·4. Oviposition begins about 15th June, shortly before the calyces close, the eggs being deposited on the leaves ; the peak is reached about four weeks later, and the eggs are then laid on the fruit as well. Oviposition ends about 2nd August. The eggs hatch in 6–16 days, the first larvae appearing about a week after the calyces close, the majority about four weeks later, and the last about the middle of August. The feeding period lasts from 12 to 73 days.

After a resting period of about 6 days the larvae giving rise to the new generation pupate between 21st July and 23rd August. The pupal stage averages 15·3 days ; during the 6 years' study the earliest date of emergence of the moths was 19th July and the latest 26th September. The oviposition period lasts 1–13 days, and the average number of eggs laid is 83·2. The incubation period lasts

6–26 days, the eggs hatching from 15th August to 15th October. The feeding period of the larvae varies from 14 to 76 days ; they begin to leave the fruit during September and continue to do so until November. Some fail to mature late in the season.

The method of entry into the fruit is described, and a list is given of varieties of apples in order of susceptibility to infestation.

STIRRETT (G. M.). **Notes on the Biology and Life-history of the Mexican Bean Beetle in Ontario.**—*59th Ann. Rep. Ent. Soc. Ontario 1928*, pp. 107–109. Toronto, 1929.

Epilachna corrupta, Muls., which had not previously been recorded in Canada, was discovered in 21 localities in Ontario on and after 20th July 1927. The damage caused during that year was very slight, and only 1,000 individuals of all stages were collected. No infestation was discovered in 1926 in districts that were infested in 1927, and it has been suggested that the beetles, which are known to be able to fly for 10–18 miles, probably migrated from Ohio or Michigan. Infestation was found in four localities in 1928, in one of which 207 bean plants were damaged over about ¾ acre. Field and laboratory observations indicate that in Ontario overwintering adults appear in the field from about 17th June to 1st July. The first eggs occur about 27th June, the incubation period lasting 7 to 12 days. The larvae begin to pupate about 20th July, the resulting adults appearing early in August. These die shortly after depositing their eggs, nearly all having disappeared by 27th September. Oviposition begins 5 or 6 days after emergence, the eggs hatching from 17th to 24th August. The larvae pupate during the latter half of September, the adults emerging from 3rd to 22nd October. Hibernation in 1927 began on 12th October and in 1928 about 30th October.

MYERS (J. G.). **Sugar-cane Moth Borers. Some recent Work on Parasites of the small Moth Borers (*Diatraea*) of Sugar-cane.**—*Trop. Agriculture*, vi, no. 11, pp. 310–312, 8 refs. Trinidad, November 1929.

This review of the literature on recent work on the biological control of *Diatraea* spp. deals chiefly with methods of assisting artificially parasites already present and the introduction of new ones. The question of the numbers of liberated parasites necessary to secure an appreciable degree of control is discussed. The effectiveness of those that attack the egg, such as *Trichogramma* [*minutum*, Riley], is materially reduced if the mortality caused among newly hatched larvae of *Diatraea* by other factors, estimated by Cleare at 90 per cent., is taken into account. It is considered that no practical calculation as to the effective rate of parasitism by *Trichogramma* can be made without further intensive biological studies. The urgent need of the moment is the rearing and liberation of at least a million egg-parasites a day, and a concentration of this total on a small area where substantial and unequivocal results can be expected. The author considers that the best manner in which co-operation can be effected is for each region to assume its own share of the work with uniform methods of recording the rates

of borer infestation and parasitism. A collection of records from all the British West Indian colonies as to the percentage of stalks and joints found to be bored at the time of cutting would serve as an estimate of the effects of parasite introduction, and be of great comparative value.

Edwards (W. H.). **The Melon and Pumpkin Borer** (*Margaronia hyalinata*).—*J. Jamaica Agric. Soc.*, xxxiii, no. 10, p. 361. Kingston, Jma., October 1929.

The Pyralid, *Diaphania* (*Margaronia*) *hyalinata*, L., is very destructive to cucurbits in Jamaica, attacking particularly melons and pumpkins, and sometimes destroying extensive plantations. Warm, wet seasons are especially favourable to it. Eggs are deposited on the lower surface of the leaves and hatch in 3–5 days, and the larvae, after more or less defoliating the plants, enter the stalks and fruit, in which they eat out long galleries and cause decay. After 2 or 3 weeks pupation takes place in closely woven cocoons in leaves that the larvae have folded or webbed together, the adults emerging in about 4 days. The remedies suggested include dusting the plants every 10 days with 1 part Paris green to 8–10 parts air-slaked lime or equal parts of lead arsenate and air-slaked lime, or spraying with Paris green. All infested plants should be destroyed.

Eggers (H.). **Zur Synonymie der Borkenkäfer** [Bark-beetles] (**Ipidae, Col.**).—*Wien. ent. Ztg.*, xlvi, no. 2, pp. 41–55. Vienna, 15th September 1929.

This discussion of the synonymy of various Scolytids includes a description of *Stephanoderes* (*Hylesinus*) *obscurus*, F., from specimens in coffee beans in Dutch Guiana. *S. gracilis*, n. n., is proposed for *S. obscurus*, Ferr.

Liebermann (J.). **Morfología y sistemática de la "tucuras" argentinas (Acridioídeos) con datos acerca de su distribución en el país y los perjuicios que causa a la agricultura nacional.** [Morphology and Classification of Argentine Grasshoppers with Data regarding their Distribution in the Country and the Damage they cause to Agriculture.]—*An. Soc. cient. argent.*, cviii, no. 6, pp. 463–496, 2 figs., 2 pp. refs. Buenos Aires, December 1929.

Very little official attention is paid to non-swarming grasshoppers in Argentina, although the annual damage caused by them is very great. Several species are involved, the most important being *Trigonophymus arrogans*, Stål. General data on the bionomics of these grasshoppers and a systematic review of the Argentine species of *Trigonophymus* and *Dichroplus* are included.

Orfila P. (R. N.). **Sobre** *Goniopterus gibberus* **Bsd.**—*Rev. Soc. ent. argent.*, ii, no. 5, pp. 269–270. Buenos Aires, 31st October 1929.

The weevil, *Gonipterus gibberus*, Boisd., which is a pest of *Eucalyptus* in Argentina, has been observed feeding on the flowers of *Chrysanthemum indicum* and of a chenopodiaceous plant, *Celosia cristata*.

McDonald (J. H.). **Coffee Growing : with special Reference to East Africa.**—Demy 8vo, xii+205 pp., 23 pls., 4 figs. London, East Africa, Ltd. 1930. Price, 21*s*. net.

This practical hand-book on coffee growing has been compiled for the use of planters, the information being taken from many sources, and includes certain chapters, such as those on insect pests, fungous diseases and manures, for the writing of which the author has received the assistance of scientific and technical experts. In the chapter devoted to insect pests, the way in which agricultural activities frequently encourage insect depredations and the principles of biological and chemical control are briefly discussed, and the author stresses the importance of finding insect-resistant strains of plants wherever possible. With one exception, all the insect pests discussed occur in East Africa. A short popular description is given of each, to enable growers to recognise it in the field, with illustrations of the more important ones; the damage done is explained, with recommendations for control, and notes on methods of rearing and increasing the numbers of existing insect enemies are included. The results of recent research by various workers are in many cases quoted. A separate chapter is devoted to the preparation and employment of insecticides, etc.

McKinney (H. H.). **Mosaic Diseases in the Canary Islands, West Africa, and Gibraltar.**—*J. Agric. Res.*, xxxix, no. 8, pp. 557–578, 21 figs., 13 refs. Washington, D.C., 15th October 1929.

An account is given of the mosaic diseases of plants encountered on an expedition to the Canary Islands, Gibraltar and West Africa. In Sierra Leone mosaic-like symptoms were found on peanut [*Arachis hypogaea*]. Aphids from affected plants produced the symptoms in healthy ones, but as they did not persist after the Aphids were removed, it is thought that this is not a disease of the virus type, but that the symptoms may be produced by toxic substances injected by the Aphids.

Morgan (W. L.). **Preliminary Experiments in Cabbage Moth Control.**—*Agric. Gaz. N.S.W.*, xl, pt. 10, pp. 761–766. Sydney, October 1929.

The cabbage moth [*Plutella maculipennis*, Curt.] is an important pest of cabbages and cauliflowers in New South Wales. During serious infestations, which occur every few years, more than 50 per cent. of the crop is destroyed. Crops planted late in the autumn and harvested early in the spring usually escape severe damage. Cruciferous weeds and even garden flowers, on which the larvae develop readily, serve as a continuous source of infestation and render control measures ineffective. During a favourable season 80 to 90 per cent. of the crop is rendered marketable by dusting with lime and tobacco, this measure giving sufficient protection until the infestation is checked by the advent of the cold weather. If the winter is late, however, severe damage to the crop may occur.

Since spraying with lead arsenate or dusting with lime and tobacco have not always given satisfactory control, experiments with these and other insecticides were conducted in 1929. Sprays of white oil emulsion, nicotine sulphate, and a derris preparation proved ineffective. Lead arsenate was used at the rate of 1½ lb. to 50 gals. water, and the best results were obtained by adding 5 oz. casein-lime spreader. This spray protected the outer leaves only, whereas dusting with equal parts of lime and tobacco apparently repelled the larvae from the centres of the plants. Very promising results were obtained by dusting and spraying alternately, and this procedure is recommended for control. The spray should be applied at intervals of about 10 days. Dusting can be carried out while the plants are still wet after the application of the spray ; better results, however, were obtained by dusting on the first dewy morning after spraying. The dust need only cover the centre leaves to drive the larvae to the outer ones. Soap used as a spreader with lead arsenate tended to check the growth of the plants, although no actual scorching of the foliage occurred, and failed to deposit the spray coating evenly. Old seed-beds are a source of infestation to the crops and should be ploughed under as soon as the plants that are required have been taken from them.

[Shtakel'berg (A. A.).] **Штакельберг (А. А.). Ueber eine neue Muscide, die als Parasit in** *Locusta migratoria* **L. auftritt.** [On a new Parasite of the Asiatic Locust (*Locusta migratoria* L.) of the Family Muscidae (*in Russian & German*).]—*Izv. prikl. Ent.*, iv, no. 1, pp. 121–129, 7 figs., 8 refs. Leningrad, 1929.

A description is given of a Muscoid fly, *Acridomyia sacharovi*, gen. et sp. n., which is parasitic on *Locusta migratoria*, L., in various parts of south-eastern Russia and Central Asia.

[Olsuf'ev (N. G.).] **Олсуфьев (Н. Г.). A Study on Flies parasitic on the Asiatic Locust** (*Locusta migratoria* **L.**) **and their Superparasites. Part i. Parasites of the Larvae and full-grown Insects.** [*In Russian.*]—*Izv. prikl. Ent.*, iv, no. 1, pp. 61–120, 40 figs., 1 map, 4 diagrs., 62 refs. Leningrad, 1929. (With a Summary in English.)

An account is given of observations carried out in 1927 and 1928 on *Blaesoxipha filipjevi*, Rohd., in Daghestan, and *B. lineata*, Fall., *B. grylloctona*, Lw., and *Acridomyia sacharovi*, Stack., in Daghestan and Kazakstan (Central Asia), where these flies are parasitic on *Locusta migratoria*, L., and other Acridids, with descriptions of the larval and adult stages. All four species are themselves parasited by *Brachymeria* (*Chalcis*) *dalmani*, Thoms., which is also described in detail.

Dissections of over 14,000 locusts and laboratory experiments showed that the four flies infest the locust at definite stages in its development. The author's studies indicate that they have little effect on large and dense swarms, owing to the low percentage of parasitism, and that only swarms already much thinned out by other causes can be controlled by them. A high percentage (up to 48 per

cent.) of parasitism occurs among the locusts during the period of oviposition, but as up to 85 per cent. survive this period, the parasites merely diminish the reproductive capacity of the females. The migrations of *L. migratoria* are not caused by parasitic flies, for the form of this locust occurring in Central Russia, which is also parasitised by them, does not migrate at all. Again, locusts do not actually get rid of the flies during migrations, for the latter migrate with them ; *B. lineata* is even specially adapted for infesting the flying locusts. Parasitic flies cannot, therefore, be considered as the regulating factors in the propagation of *L. migratoria* or as affecting its periodicity in the original breeding grounds in the lowlands between the Aral and Caspian seas.

[Petrov (A. D.), Reǐkhardt (A. N.) & Isachenko (V. B.).] **Петров (А. Д.), Рейхардт (А. Н.) и Исаченко (В. Б.). Ueber die Anwendbarkeit des Chlorpikrins als Bekämpfungsmittel gegen Bohrkäfer und Kleidermotte.** [The Use of Chloropicrin for the Fumigation of Warehouses and Dwellings (*in Russian*).]—*Izv. prikl. Ent.*, iv, no. 1, pp. 131–150, 13 figs., 19 refs. Leningrad, 1929. (With a Summary in German.)

Anobium punctatum, DeG. (*domesticum*, Geoffr.) is the most common of the beetles that bore in furniture, beams and other woodwork in houses in Leningrad ; the adults are abundant from the second half of April till about mid-July. Other wood-borers in order of their importance are : *Codiosoma spadix*, Hbst., *Sitodrepa* (*Stegobium*) *panicea*, L., which is chiefly a pest of stored products but occasionally attacks furniture made of soft wood, and *Trypopitys* (*Priobium*) *carpini*, Hbst., *Bostrychus capucinus*, L., *Coelostethus* (*Anobium*) *pertinax*, L., and *Lyctus linearis*, Goeze (*canaliculatus*, F.), which are rare. *Tineola bisselliella*, Humm., is the most common clothes moth.

An account is given of a number of successful experiments with chloropicrin, chiefly against *A. punctatum* and *T. bisselliella*. At 10° C. [50° F.] larvae of the former in pieces of willow basket were killed in 24 hours with 8 oz. to 1,000 cu. ft. With 9 and 1½ oz., larvae of *T. bisselliella* in their cocoons were killed in 2½ and 72 hours respectively. The fumigant easily penetrated planks about an inch thick used for the manufacture of furniture, killing all the Anobiid larvae at the same concentration as in the first experiment with a slightly longer exposure. In thicker planks, infested at a depth of about 2 ins., the dosage and exposure had to be considerably increased, unless vacuum fumigation was employed. Folded thick fabrics and furs fumigated with 20 oz. to 1,000 cu. ft. were penetrated under ordinary atmospheric pressure. Fabrics absorb chloropicrin more readily than carbon bisulphide and therefore require longer airing than when the latter is used. Absorption by wood is highest in pine, and depends on the way in which it has been dried, polished, etc. The gas did not affect the durability or colour of fabrics or furs, and did not tarnish metals or injure paper. It was found to kill fungi and bacteria, whereas carbon bisulphide did not. It is also cheaper and safer to use than the latter or hydrocyanic acid.

A low concentration of the gas and a long exposure is preferable to a high concentration for a short time.

[Pospelov (V. P.) & Noreĭko (E. S.).] **Поспелов (В. П.) и Норейко (Е. С.). Wilt Disease (Polyederkrankheit) of Caterpillars and the Yeast,** *Debaryomyces tyrocola* **Kon., as its Virus.** [*In Russian.*]—*Izv. prikl. Ent.*, iv, no. 1, pp. 167–183, 6 figs., 22 refs. Leningrad, 1929. (With a Summary in English.)

The literature on polyhedral diseases of Lepidopterous larvae is reviewed. In studying the occurrence of the disease in larvae of *Lymantria* (*Porthetria*) *monacha*, L., in the Penza Government, the authors found that healthy individuals could be infected *per os* by means of the yeast, *Debaryomyces tyrocola*, obtained from the diseased larvae. Further experiments were therefore carried out with the larvae of other Lepidoptera by feeding them on leaves contaminated with a few drops of an agar culture of the yeast diluted with water. Infection was produced in *Bombyx mori*, L., *Barathra brassicae*, L., and *Euxoa* (*Feltia*) *segetum*, Schiff., though with *Pieris brassicae*, L., and *P. rapae*, L., which were almost ready to pupate, the results were inconclusive. The forms of the polyhedral bodies and the pathological changes occurring in the various larvae are described in detail. In the case of the silkworms, which were in the fifth instar, the period of incubation varied from 5 to 13 days, being more rapid when the humidity was higher. As polyhedral bodies occurred in the nuclei and cytoplasm of the malpighian tubes and in the spinning glands of the larvae, the authors believe that they are metabolic products. As silkworms in a control experiment remained healthy under similar conditions of humidity, it was evident that though moisture accelerated the infection it was not its primary cause. Those fed on contaminated leaves in a room on an open shelf under favourable conditions did not develop any symptoms of the disease. Larvae of *L. monacha* that were kept in an insectary at a lower temperature than the one prevailing in the infected region remained healthy, although analysis of their body fluid revealed the presence of polyhedral bodies in a passive state.

The authors conclude that the yeast contains the virus that causes the disease under conditions of a high humidity and temperature, damp food, and crowding. As, however, no yeast could be found in the infected larvae, the virus is filterable, being an ultramicroscopic evolutive form of the yeast.

[Voĭnovskaya-Kriger (T.).] **Войновская-Кригер (Т.). Einige Worte über die Parasiten von** *Oscinella frit* **L.** [A few Data on the Parasites of the Frit Fly (*Oscinella frit* L.) (*in Russian*).]—*Izv. prikl. Ent.*, iv, no. 1, pp. 185–188, 16 refs. Leningrad, 1929. (With a Summary in German.)

Parasites bred from *Oscinella frit*, L., in the Leningrad Government in 1925–27 were *Trichomalus cristatus*, Först., *Halticoptera petiolata*, Thoms., *Merisus intermedius*, Lind., *Eucoela* (*Rhoptromeris*) *widhalmi*, Kurd., *Loxotropa tritoma*, Thoms., *Ashmeadopria* (*Diapria*) *variipes*, Kieff., *Chasmodon apterus*, Nees, and *Dacnusa tristis*, Nees. All these parasites attacked the larvae in infested stems, and pupated in the puparia of the host, the adults emerging singly about a fortnight later than the usual date of the emergence of the fly. *T. cristatus* and *E. widhalmi* were the most numerous species, the former being probably a secondary parasite and the latter a primary one. No observations

were made to determine whether the other species are primary or secondary parasites. Data from the literature show that in Russia the numbers of the frit fly destroyed by parasites are usually low, 50 per cent. parasitism being exceptional. In these experiments the percentages varied from 2·5 to 34.

[Predtechenskiĭ (S. A.).] Предтеченский (С. А.). **Das Ural-Delta in orthopterologischer Hinsicht.** [The Orthoptera of the Ural Delta (*in Russian*).]—*Izv. prikl. Ent.*, iv, no. 1, pp. 219–223, 1 ref. Leningrad, 1929. (With a Summary in German.)

Swarms of *Locusta migratoria*, L., appear annually in the delta of the Ural river, but the reed-beds (*Phragmites communis*) and grassy meadows that serve as breeding grounds are not very extensive and are subject to spring floods. In 1928 about 11½ square miles of egg-deposits were flooded and none of the eggs hatched.

[Meĭer (N. F.).] Мейер (Н. Ф.). **Schlupfwespen, die in Russland in den Jahren 1881-1926 aus Schädlingen gezogen sind (Vortsetzung).** [Parasites bred in Russia from injurious Insects during 1881–1926 (Continuation) (*in Russian*).]—*Izv. prikl. Ent.*, iv, no. 1, pp. 231–248, 4 pp. refs. Leningrad, 1929.

This list is supplementary to a previous one [*R.A.E.*, A, xvi, 200], but includes Chalcidids and Proctotrupids as well as Ichneumonids and Braconids.

[Petrov (A. D.) & Savel'ev (A. O.).] Петров (А. Д.) и Савельев (А. О.). **Ueber die Zersetzung des Chlorpikrins bei Erwärmung und beim Kontakt mit Metallen.** [The Decomposition of Chloropicrin when heated and in Contact with Metals (*in Russian*).]—*Izv. prikl. Ent.*, iv, no. 1, pp. 271–274, 5 refs. Leningrad, 1929. (With a Summary in German.)

Experiments showed that the decomposition of chloropicrin under the influence of heat increased in an almost direct proportion to the rise of temperature and the duration of the exposure, being ten times more when it was heated at its boiling point, 112·7° C. [267° F.], than at 100° C. [212° F.]. Prolonged exposure to a high temperature should therefore be avoided in fumigation. Contact with metals increased the decomposition of chloropicrin, but not to such an extent as to inhibit the use of metal containers. Of various metals, iron had the least effect.

[Polsman (E. S.).] Полсман (Е. С.). **Ueber** *Locusta migratoria* **L. im Gouv. Tshernigov.** [A Note on the Asiatic Locust (*Locusta migratoria* L.) in the Chernigov Government (*in Russian*).]—*Izv. prikl. Ent.*, iv, no. 1, pp. 275–276. Leningrad, 1929. (With a Summary in German.)

Isolated specimens of *Locusta migratoria* [subsp. *rossica*, Uv. & Zol.] were collected on dry sandy places in the Chernigov Government. *Blaesoxipha lineata*, Fall., was bred from one of the locusts.

[Petrov (A.).] **Петров (А.). New Methods of applying Hydrocyanic Acid in the Control of Pests.** [*In Russian.*]—*Izv. prikl. Ent.*, iv, no. 1, pp. 288–290, 4 refs. Leningrad, 1929.

This is a short review of the use of Zyklon products and of calcium cyanide for fumigating with hydrocyanic acid gas.

[Kamuishnuiĭ (N.).] **Камышный (Н.). The Seed-abundance in Apples and their Infestation by** *Cydia pomonella* **L.** [*In Russian.*]—*Visn. Sadiv. Vinogr. Gorodn.*, v, no. 10–11, pp. 495–499. Kharkov, 1929.

This is a preliminary report on observations carried out in the Ukraine in the summer of 1926, in view of the suggestion that the rate of infestation of apples by *Cydia pomonella*, L., is related to the number of seeds contained in them. It was found that the number of carpels had no influence on infestation and that the percentage of seedless apples attacked did not differ appreciably from that of the normal ones. The author does not, however, consider these results decisive.

[Fedorov (S. M.).] **Федоров (С. М.). Pests of Vines in the Crimea observed in 1927-1929.** [*In Russian.*]—*Vestn. Vinogr. Vinod. Vinotorg.*, xxx, no. 2, pp. 90–92, 2 refs. Odessa, November 1929.

As a result of the extremely severe winter of 1927–28, followed by a very cold spring, no serious outbreaks of vine pests occurred in the Crimea in 1928 ; some of them were more injurious in 1929. All of the pests mentioned were recorded in previous reports [*R.A.E.*, A, xv, 342 ; xvi, 547]. Observations indicate that *Pseudococcus citri*, Risso, which was very common in the environs of Yalta, is the only species of the genus that occurs on vines in the Crimea, having been erroneously recorded as *P. vitis*, Nied., or *P. adonidum*, L. (*longispinus*, Targ.).

[Printz (Ya. I.).] **Принц (Я. И.). A Contribution to the Question of the Hybridisation of the Grape-vine.** [*In Russian.*]—*Trud. Vsesoyuzn. S'ezda Genet. Selektz.*, iii, pp. 447–451. Leningrad, 1929.

This is a discussion of the possibility of cultivating in Azerbaijan varieties of vines that would be resistant to the attacks of *Phylloxera* and other pests. The character of the damage caused by *Tetranychus* (*Epitetranychus*) *telarius*, L. (*althaeae*, v. Hanst.), *Polyphylla fullo*, L., *Polychrosis botrana*, Schiff., and *Pseudococcus citri*, Risso, is briefly outlined, with notes in each case on the characteristics and varieties of vines attacked. Hybridisation might cause the production of characters that would render the vines unattractive to several pests.

[Vereshchagin (B.).] **Верещагин (Б.). Pests of Vineyards and their Control.** [*In Russian.*]—*Sel'skokhoz. Byull.*, no. 11–12, pp. 37–38. Kishinev, November–December 1929.

[Vereshchagin (B.).] **Верещагин (Б.). The red Spider Mite** *Tetranychus telarius* **L.** (*althaeae* **v. Hanst.**). [*In Russian.*]—*Furnika*, no. 20, extract 1 p. Kishinev, 15th October 1929.

The first of these popular papers contains a list of insects attacking vines in Bessarabia, with brief notes on the bionomics and control of

the more important ones, *viz.*, *Phylloxera vastatrix*, Planch., *Clysia* (*Conchylis*) *ambiguella*, Hb., *Lethrus apterus*, Laxm., *Epicometis* (*Tropinota*) *hirta*, Poda, *Melolontha melolontha*, L., *Polyphylla fullo*, L., and *Tetranychus telarius*, L. (*althaeae*, v. Hanst.). A slightly fuller account of *T. telarius* is given in the second paper.

Schwangart [F.]. **Anmerkungen zur biologischen Bekämpfung der Traubenwickler.** [Notes on the biological Control of the Vine-moths.]—*Anz. Schädlingsk.*, v, no. 11, pp. 140–142. Berlin, 15th November 1929.

In connection with the biological control of the vine-moths [*Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff.] in Germany, it is pointed out that the vineyards are small so that all parts of them are accessible to parasites coming from alternative hosts on other food-plants. This is not the case in Italy, where the vineyards cover large areas, so that regular interplanting of such food-plants is required. The Tachinids that attack *Hyponomeuta cognatellus*, Hb., on *Euonymus* are of more importance as parasites of *Sparganothis* (*Oenophthira*) *pilleriana*, Schiff., than of the other vine-moths [*cf.* *R.A.E.*, A, viii, 356].

Okunewsky (J. L.). **Das Schwefeldioxyd und seine Anwendung in der Praxis.** [Sulphur Dioxide and its practical Employment.]—*Z. Desinfekt.*, xxi, no. 6, pp. 148–155, 15 refs. Dresden, June 1929.

Russian literature on the injury to textiles, etc., caused by fumigation with sulphur dioxide is briefly reviewed, and the results of experiments in Leningrad are shown in tables. It is concluded that the use of this fumigant must be restricted, as it affects the appearance and durability of fabrics. Any rooms or objects subjected to fumigation must be thoroughly dry.

Novak (P.). **Bekämpfung der Olivenfliege auf der Insel Jž im Jahre 1928.** [Work against the Olive Fly in the Island of Jz in 1928.]—*Nachr. SchädlBekämpf.*, iv, no. 2, pp. 62–65. Leverkusen a. Rh., August 1929.

Dacus oleae, Gmel., and *Prays oleellus*, F., cause serious losses to olives in Dalmatia, both having three generations a year. The larvae of the first generation of *P. oleellus* destroy the fleshy part of the leaves in winter and early spring, those of the second attack the blossoms, and those of the third bore into the fruits, which they leave at the end of August or early in September. This moth is a more serious pest than *D. oleae* in Dalmatia, as it sometimes causes the loss of the entire crop.

An account is given of successful experiments on a large scale with a proprietary bait-spray against *D. oleae*.

Storey (H. H.). **A Mosaic Virus of Grasses, not virulent to Sugar Cane.**—*Ann. Appl. Biol.*, xvi, no. 4, pp. 525–532, 7 refs. Cambridge, November 1929.

In the Transvaal, mosaic was first observed in 1924 in *Sorghum arundinaceum*. A mosaic disease that appeared to be identical was also found to be widely distributed in maize and cultivated *Sorghum*, but

sugar-cane in this region was not affected. The symptoms produced in maize and *Sorghum* were indistinguishable from those caused by the virus of sugar-cane mosaic in these hosts. Experiments showed that *Aphis maidis*, Fitch, was capable of transmitting the disease to maize, but sugar-cane failed to become infected both in field experiments extending over three years in the Transvaal and in large cage experiments in Natal, although by using the same method, successful transmission of mosaic to sugar-cane took place when the source of infection was either diseased cane or infected grasses collected in the neighbourhood of diseased cane. It is therefore concluded that the virus from the Transvaal is different from the common sugar-cane mosaic virus in Natal.

WILSON (G. F.). **Pollination of Hardy Fruits: Insect Visitors to Fruit Blossoms.**—*Ann. Appl. Biol.*, xvi, no. 4, pp. 602–629, 28 refs. Cambridge, November 1929.

This is a detailed discussion of the work carried out in Surrey during the years 1920–25 on the species of insects concerned in the pollination of the blossoms of orchard trees and small fruits, a popular account of which has already been noticed [*R.A.E.*, A, xv, 61]. The species of insects taken on the various blossoms are listed, with some data as to their habits and abundance. The numbers of insects other than bees increase when the orchards are in the proximity of open country, pasture land, etc. The work of other authors on the transference of pathogenic organisms by anthophilous insects is discussed, and the author records the finding of isolated individuals of *Eriophyes ribis*, Nal. (black currant mite) on the legs of bees captured while they were visiting infested bushes.

LYALL (E.). **The Larva and Pupa of** *Scatopse fuscipes* **Mg. and a Comparison of the known Species of Scatopsid Larvae.**—*Ann. Appl. Biol.*, xvi, no. 4, pp. 630–642, 14 figs., 13 refs. Cambridge, November 1929.

At a London dock during the autumn of 1927 larvae and pupae of *Scatopse fuscipes*, Mg., were found in decaying green ginger that had been damaged by water. Previous work on Scatopsine larvae is reviewed, and the larva and pupa of *S. fuscipes* are described, the larva being briefly compared with those of other species of the same genus.

STRICKLAND (E. H.). **Larder Beetle Infestations arising from Tent Caterpillars.**—*Canad. Ent.*, lxi, no. 10, p. 238, 1 ref. Orillia, Ont., October 1929.

The author records two instances of *Dermestes lardarius*, L., breeding in dead adults of Calliphorids in houses in Alberta [*cf.* *R.A.E.*, A, xvii, 230].

Complaints of infestation of houses near Edmonton by this beetle from 1924 to 1926 coincided with a severe outbreak in the adjacent forest of *Malacosoma disstria*, Hb., cocoons of which were numerous under window-sills. Many of the larvae or pupae in these died, and adults of *D. lardarius* were attracted to them for oviposition. Numbers of the resulting larvae entered the houses through the mosquito

screens, the mesh of which was too small for the adult beetles to pass through. Within a few days they were found in flour bins, etc. As soon as the outbreak of *M. disstria* ended, complaints of infestation by *D. lardarius* ceased, but larvae and adults continued to occur in houses in the eastern part of the Province, where *M. disstria* was still very numerous.

STEARNS (L. A.). **Oriental Peach Moth Investigation in 1925 and 1926. A summarized Report.**—*Circ. New Jersey Agric. Expt. Sta.*, no. 208, 15 pp., 4 figs. New Brunswick, N.J., October 1927. [Recd. 1929.]

Much of this information on investigations on the oriental peach moth [*Cydia molesta*, Busck] in New Jersey has been noticed from other sources [*R.A.E.*, A, xv, 261 ; xvi, 134]. The economic status of the parasites, *Macrocentrus ancylivora*, Roh., and *Glypta rufiscutellaris*, Cress., is briefly discussed. Experiments in control included tests with nicotine sulphate and Volck oil against the eggs and young larvae ; subsequent experiments have already been noticed [*R.A.E.*, A, xvii, 180, 669].

PAPERS NOTICED BY TITLE ONLY.

[MAMONOV (B. A.).] **Мамонов (Б. А.). Mining Diptera in the Vicinity of Rostov on the Don.** [*In Russian.*]—*Byull. Sev.-Kavzkask. Kraev. sel.-khoz. opuitn. Sta.*, no. 292, 20 pp., 7 figs., 4 refs. Rostov-on-Don, 1929. (With a Summary in English.)

[BOLDUIREV (V. F.).] **Болдырев (В. Ф.). Spermatophore Fertilization in the Migratory Locust** (*Locusta migratoria* **L.**). [*In English.*] —*Izv. prikl. Ent.*, iv, no. 1, pp. 189–218, 18 figs., 16 refs. Leningrad, 1929. (With a Summary in Russian.)

SCHRADER (F.). **Notes on Reproduction in** *Aspidiotus hederae* (**Coccidae**). —*Psyche*, xxxvi, no. 3, pp. 232–236, 4 figs., 3 refs. Boston, Mass., September 1929.

TRIMBLE (F. M.). **Scale Insects injurious in Pennsylvania.** —*Bull. Pennsylvania Dept. Agric.*, xii, no. 11 (Gen. Bull. 480), 21 pp., 2 pls. Harrisburg, Pa., August 1929. [Revision of previous bulletin (see *R.A.E.*, A, xiii, 563).]

HEMPEL (A.). **Descripções de pulgões novos e pouco conhecidos** (**Homoptera, Coccidae**). **2a. Contribuição.** [Descriptions of new or little-known Coccids from Brazil. 2nd Contribution.]—*Arch. Inst. biol.*, ii, pp. 61–66, 2 pls. S. Paulo, 1929. [*Cf. R.A.E.*, A, xvii, 616.]

BALACHOWSKY (A.). **Contribution à l'étude des Coccides de l'Afrique mineure (6e note). Faune du Hoggar.**—*Ann. Soc. ent. Fr.*, xcviii, no. 3, pp. 301–322, 1 pl., 2 maps, 27 figs., 16 refs. Paris, 31st October 1929.

WÜNN (H.). **Bemerkungen über Cocciden. III. Uebersicht über die in Baden beobachteten Schildlausarten. IV. Schildläuse an Weisstannen.** [Observations on Coccids. III. List of the Coccids observed in Baden. IV. The Coccids on *Abies pectinata.*]—*Badische Bl. angew. Ent.*, ii, no. 7, pp. 368–372. Freiburg i. Br., June 1929.

RIBAUT (H.). **Une nouvelle espèce française du genre** *Phytocoris.* **(Heteroptera-Capsidae.)** [*P. buxi*, sp. n., on box (*Buxus*) in the Pyrenees.]—*Bull. Soc. Hist. nat. Toulouse,* lvii, no. 4, pp. 440–442. Toulouse, 30th March 1929.

KNECHTEL (W. K.). **Neuer Beitrag zur Kenntnis der Thysanopteren-Fauna von Rumänien.** [New Contribution to the Knowledge of the Thysanoptera of Rumania.]—*Bull. Acad. roum. Sect. scient.,* xii, no. 3, pp. 1–3. Bucarest, 1929. [A List of 17 further Species ; *cf. R.A.E.*, A, xiii, 572.]

FRANÇOIS (E.). **Sur deux ennemis de la pomme de terre à Madagascar.** —*Bull. écon. Madagascar,* Partie Document., xxiv, no. 1, pp. 90–91. Antananarivo, 1927. [See *R.A.E.*, A, xv, 361.]

BODENHEIMER (F. S.). **Is** *Lixus algirus* **an injurious Insect?** [In Hebrew.]—*Yedeoth, Proc. Agric. Expt. Sta.,* vii–viii, pp. 322–323. Tel-Aviv, Palestine, December 1927. (With a Summary in English, pp. 346–347.) [See *R.A.E.*, A, xvi, 495.]

FRICKHINGER (H. W.). **Der Messingkäfer und seine Bedeutung.** [*Niptus hololeucus,* Fald., and its Importance.]—*Der prakt. Desinfektor,* xxi, no. 3, pp. 38–41, 2 figs., 10 refs. Dresden, March 1929. [*Cf. R.A.E.*, A, xvi, 214, 215, 289, 375, etc.]

BLACKMAN (M. W.). **The Genus** *Pityophthorus* **Eichh. in North America : a revisional Study of the Pityophthori, with Descriptions of two new Genera and seventy-one new Species.**—*Bull. N.Y. State Coll. For.,* Tech. Pub. no. 25, pp. 5–183, 11 pls. Syracuse, N.Y., September 1928.

BLACKMAN (M. W.). **Notes on Micracinae with Description of twelve new Species.**—*Bull. N.Y. State Coll. For.,* Tech. Pub. no. 25, pp. 185–208. Syracuse, N.Y., September 1928.

EGGERS (H.). **Zehn neue** *Loganius*-**Arten (Ipidae, Col.) aus Südamerika.** [Ten new Species of *Loganius* from South America.]—*Wien. ent. Ztg.,* xlvi, no. 2, pp. 59–65. Vienna, 15th September 1929.

[CHORBADZHIEV (P.).] **Чорбаджиев (П.). Beitrag zur Kenntnis der Borkenkäfer Bulgariens.** [Contribution to the Study of Bark-beetles in Bulgaria. (*In Bulgarian.*)]—*Spis. b'lg. Akad. Nauk.,* xxxix, pp. 147–186, 41 refs. Sofia, 1929. (With a Summary in German.)

HARMAN (S. W.). **The Fruit Tree Leaf Roller** [*Tortrix argyrospila,* Wlk.] **in western New York.**—*Circ. N.Y. Agric. Expt. Sta.,* no. 111, 11 pp., 6 figs. Geneva, N.Y., March 1929. [*Cf. R.A.E.*, A, xvii, 269.]

MUTTKOWSKI (R. A.). **The Ecology of Trout Streams in Yellowstone National Park.**—*Roosevelt Wild Life Annals,* ii, no. 2, pp. 154–240, 64 figs., 2 pp. refs. Syracuse, N.Y. : N.Y. State Coll. Forestry, October 1929.

MUTTKOWSKI (R. A.) & SMITH (G. M.). **The Food of Trout Stream Insects in Yellowstone National Park.**—*Roosevelt Wild Life Annals,* ii, no. 2, pp. 241–263, 9 refs. Syracuse, N.Y. : N.Y. State Coll. Forestry, October 1929.

ROBINSON (R. H.) & WHITAKER (C. F.). **The Chemical Composition of Insecticides and Fungicides. (1926-1927 Report.)**—*Circ. Oregon Agric. Expt. Sta.,* no. 84, 15 pp. Corvallis, Ore., January 1927. [*Cf. R.A.E.*, A, xv, 184.]

PERROT [E.]. **La situation actuelle, pour la France, de la culture du chrysanthème insecticide (Pyrèthre).**—*C.R. Acad. Agric. Fr.,* xv, no. 25, pp. 885–890. Paris, 1929. [*Cf. R.A.E.*, A, xvi, 499.]

Breakey (E. P.). **The Entomological Commission at Work in Southern Kansas.**—*10th Rep. Kansas Ent. Commiss. 1925–1926*, pp. 6–18, 5 plans.

Gates (L. M.). **Report of Orchard Inspection Work in the North Half of Kansas.**—*T.c.*, pp. 18–29. Topeka, Kans., 1927.

Accounts are given of the work of the Entomological Commission in southern Kansas, the activities of which, apart from the inspection of imported stock and nurseries, were mainly directed against insects injurious to forest and orchard trees; and of orchard inspection work in the northern half of the State in 1925 and 1926. Considerable progress was made in the eradication of hedges of osage orange [*Maclura aurantiaca*] infested with San José scale [*Aspidiotus perniciosus*, Comst.] [*R.A.E.*, A, xvii, 226], about 110 miles of hedge having been removed in one district alone. Power sprayers have been introduced in many localities for use on trees or shrubs infested by insect pests, including the European elm scale [*Gossyparia spuria*, Mod.], the presence of which only became known in 1924 [xv, 76].

Dean (G. A.). **Some Insects injurious to Nursery Stock in the Nursery Row.**—*10th Rep. Kansas Ent. Commiss. 1925–1926*, pp. 29–34. Topeka, Kans., 1927.

Popular notes are given on the life-history and control of the following insects attacking nursery stock in Kansas: *Empoasca fabae*, Harr. (*mali*, LeB.) (apple leaf-hopper); *Psorosina hammondi*, Riley (apple-leaf skeletoniser); *Peronea minuta*, Rob. (lesser apple-leaf folder); *Thrips* spp., which injure apples by causing stunting of grafts or one-year-old trees; *Haltica foliacea*, Lec. (apple flea-beetle); *Eriosoma lanigerum*, Hausm. (woolly apple aphis); *Thyridopteryx ephemeraeformis*, Haw., which defoliates a variety of plants, particularly apple and pear; *Ancylis comptana*, Fröl. (strawberry leaf-roller); *Tyloderma fragariae*, Riley (strawberry crown borer); *Lachnosterna* (*Phyllophaga*) spp., the larvae of which cause serious injury to strawberry and apple seedlings by cutting off the main roots; and *Tetranychus telarius*, L., which attacks many species of plants, particularly raspberry and blackberry.

Hungerford (H. B.) & Dean (G. A.). **Control of the European Elm Scale** (*Gossyparia spuria* **Modeer**).—*Circ. Kansas Ent. Commiss.*, no. 9, 8 pp., 4 figs. Topeka, Kans., 1929.

Owing to a further infestation of elm by the Coccid, *Gossyparia spuria*, Mod., in Kansas in 1928, a brief popular account is given of its distribution, bionomics and control in the United States [*cf. R.A.E.*, A, xii, 445; xv, 76], where all varieties of native and imported elm are subject to attack, *Ulmus fulva* being the most susceptible.

Patterson (J. E.). **The Pandora Moth, a periodic Pest of Western Pine Forests.**—*Tech. Bull. U.S. Dept. Agric.*, no. 137, 19 pp., 8 figs., 10 refs. Washington, D.C., October 1929.

During the years 1918–25, thousands of acres of mature western yellow pine (*Pinus ponderosa*) in Oregon were severely defoliated by the Saturniid, *Coloradia pandora*, Blake. *P. jeffreyi* is also attacked

at times, and *P. murrayana* when it occurs in stands of yellow pine. Outbreaks of this moth seem to recur in southern Oregon at intervals of 20 or 30 years and last for about 6 or 8 years. The eggs are deposited in clusters on the trees, or on undergrowth or litter on the ground, and hatch in about 40 days; the larvae feed in colonies on the needles of terminal shoots during the summer and hibernate at the base of the needles. Feeding is resumed next spring, when large numbers of needles are devoured. Pupation begins in June, from 1 to 5 inches below the ground surface, and the pupal stage lasts for a full year; loose, pumice soil seems almost essential for successful development, and it is only in this type of soil that outbreaks have arisen. Although complete defoliation of the trees may sometimes occur, the result is not always fatal, as the terminal buds are not eaten by the larvae and the trees are severely attacked only in alternate years. The greatest loss is due to suppression of the trees' growth, and even more to secondary attack by the bark-beetles, *Dendroctonus brevicomis*, Lec., and *D. monticolae*, Hopk. It is suggested that the larvae might be successfully controlled by spraying with arsenicals during the spring period of maximum feeding, but this method is too expensive to be practicable after an outbreak has developed. Aeroplane dusting might be effective and less expensive. Parasites recorded from *C. pandora* are the Tachinid, *Blepharipeza adusta*, Lw., the larvae of which emerge from the larvae of the host after the latter have entered the ground for pupation, and themselves pupate in the soil; and the Chalcids, *Tetrastichus* sp. and *Trichogramma minutum*, Riley, both of which attack the eggs. The larvae are subject to a wilt disease and are destroyed by birds; and various small rodents dig up and eat the pupae.

Howard (L. O.). **The Rise of Applied Entomology in the United States.** —*Agric. Hist.*, iii, no. 3, pp. 131–139. Washington, D.C., July 1929.

The history of the development of economic entomology in the United States is reviewed, and some examples are given of the importance of insect pests and the large sums now spent on their suppression. The need for increasing the numbers of entomological workers and obtaining the assistance of farm organisations, and, above all, the co-operation of workers in other branches of science, is pointed out.

Busck (A.) & Dampf (A.). **Una palomilla** (*Stenoma crambina*, **Busck**) **como una nueva plaga del algodón en el Estado de Oaxaca.** [*S. crambina* as a new Pest of Cotton in the State of Oaxaca, Mexico.] —*Estud. Ofic. fed. Defensa agríc. México*, no. 2, 55 pp., 24 figs., 1 pl., 24 refs. San Jacinto, D.F., 1929.

The first part of this paper is by Busck and contains his original description of *Stenoma crambina*, with a Spanish translation. In the second part, Dampf describes the larva and pupa, and gives the results of observations on this moth on cotton in the Mexican state of Oaxaca in 1929. The larva mines in the bark, both of slender twigs and stems 3 inches thick. Pupation takes place in a groove in the bark, under a shelter formed of silk and excreta.

Dwight (J. L.). **The Mediterranean Fruit Fly in Hawaii.**—*Hawaii. For. Agric.*, xxvi, no. 3, pp. 113–116. Honolulu, July–September 1929.

A short history is given of *Ceratitis capitata*, Wied., in Hawaii since its introduction into the Islands in 1910. The attempts made to control it are briefly reviewed, and some account is given of the introduction of its parasites into the Islands. After about 20 years these parasites are now killing 50 per cent. of the flies developing on all food-plants around Honolulu.

Termite Protection.—*Hawaii. For. Agric.*, xxvi, no. 3, p. 134. Honolulu, July–September 1929.

Compulsory provisions for the protection of buildings against termites that have recently been incorporated in the building code of the Hawaiian Islands on the recommendation of T. E. Snyder are reproduced [*cf. R.A.E.*, A, xviii, 114].

Newman (L. J.). **Red Legged Earth Mite.**—*J. Dept. Agric. W. Aust.*, (2) vi, no. 3, pp. 449–452. Perth, W.A., September 1929.

An account is given of the bionomics and control of the red-legged earth mite [*Penthaleus destructor*, Tuck.] in Western Australia [*R.A.E.*, A, xi, 571 ; xiv, 50, 204 ; xv, 350]. Clovers are particularly subject to attack and should be grown in mixture with other pasture. The mites float in large numbers on the surface of running water, which should therefore be diverted by means of drains to prevent their introduction from contiguous infested areas. Plants should be raised from seed to avoid movement of seedlings or cuttings that might be infested. The mites may also be transported by sheep from infested pastures. Thorough burning over of the fields will destroy aestivating eggs, but when pastures are eaten down, it is not possible to maintain a good fire in them.

Kuwana (I.). **Biological Notes on two Egg-parasites of the Rice Stem-borers in Japan.**—*Proc. 4th Pacific Sci. Cong., Java, 1929*, pp. 379–384. [? Batavia] 1929.

Trichogramma japonicum, Ashm., and *Phanurus* (*Ceraphron*) *beneficiens*, Zehnt., which are egg parasites of the rice stem-borers, *Chilo simplex*, Butl., and *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), occur in all parts of the Japanese Empire except the extreme north. *S. bipunctifer*, however, does not occur in the region where these observations were made, so that the data given concern *C. simplex* only.

T. japonicum, all stages of which are briefly described, is the most widely distributed and effective of all the natural enemies of the borers, its hosts including 30 species of Lepidoptera, mainly Tortricids and Pyralids. There are upwards of 15 generations a year in Japan, and the winter is passed in the mature larval stage in the eggs of the hosts. The adults appear in late April and produce one or two generations in the eggs of various small moths other than *Chilo*. When the eggs of the latter are laid in the rice beds in late May, the parasites attack them, and by the middle or end of July, when they are no longer available,

5 or 6 more generations have occurred. Two or three generations are then produced in the eggs of other Lepidoptera, after which the eggs of the second brood of *C. simplex* appear. Several generations occur on these and other hosts, until hibernation takes place. In most cases only one parasite develops in each egg of *C. simplex*. No instance has been observed of more than 3 larvae maturing in a single egg, though the percentage of eggs in the field yielding 2 or more parasites may be as high as 20–30. The number of eggs deposited by a female averages 40, with a maximum of 70. Under laboratory conditions the adults were able to fly for a distance of 30 ft. in 2–3 minutes. They are inactive at night.

P. beneficiens, although generally distributed, is less effective as a parasite of *C. simplex* than *T. japonicum*. The adult is briefly described. Only a few hosts, all of which are closely related to *C. simplex*, are known to be attacked. Winter is passed in the adult stage, and there are 11–12 generations a year. The adults usually become active in late April. Only one egg is laid in each host egg, the females depositing an average of 50 in spring and over 100 in summer. Parthenogenetic reproduction results in male progeny only. Females fed with honey solution in the laboratory lived over 30 days.

The eggs of the spring brood of *C. simplex* are much more heavily parasitised than those of the second, infestation increasing from 1–3 per cent. in early June to 50–80 per cent. in late June or early July. The average field parasitism ranges from 4 to 72 per cent., varying greatly in different regions and from year to year. The effectiveness of both parasites could be greatly increased by artificial propagation. *T. japonicum* is being reared in numbers upon the eggs of *Pyralis farinalis*, L.

E[DWARDS] (W. H.). **Notes sur les borers de la canne à sucre.**—*Leafl. Dept. Agric. Maurice*, no. 18, 4 pp., 1 ref. Mauritius, 1926.

In view of renewed outbreaks of the sugar-cane borers, *Sesamia vuteria*, Stoll, *Diatraea venosata*, Wlk. (*sacchariphaga*, Bojer) and *Eucosma* (*Grapholitha*) *schistaceana*, Sn., in many localities of Mauritius, a short account is given of their bionomics and the methods practised for their control [*R.A.E.*, A, v, 440].

EDWARDS (W. H.). **Le** *Phytalus smithi* (**Arrow**).—*Leafl. Dept. Agric. Maurice*, no. 28, 7 pp. Mauritius, 1928.

An account is given of the present situation in Mauritius with regard to *Lachnosterna* (*Phytalus*) *smithi*, Arrow. Efforts should be made to collect increased numbers of the beetles by encouraging the growth of *Cordia interrupta* along the borders of infested sugar-cane fields; this plant attracts them and also serves as food for the adults of the Scoliid parasites that destroy the larvae. Where it does not grow, maize plants, on which the beetles collect, might be grown at intervals of 15 to 20 ft. Grasses among which they can hide should be cleared from the fields and paths. Brambles should be destroyed on uncultivated land, and all branches of trees between the heights of 5 and 20 ft. should be cut off. To prevent oviposition in fields required for planting, grass should not be allowed during the summer, and branches should be placed at intervals from which the beetles can be hand-collected. The best insecticide for destroying the larvae in

the soil was found to be a kerosene-creoline emulsion, which, when used freely, killed all larvae without injuring the canes. This is, however, too expensive a method except for newly discovered infestations or small areas. Biological control is the cheapest and most successful, and every effort should be made to increase the work of natural enemies. These include the Scoliids, *Tiphia parallela*, Smith, which is abundant from April to June, and required 109–112 days for its life-cycle in the insectary, and *Campsomeris* (*Elis*) *thoracica*, F. [*R.A.E.*, A, xi, 133, 135], which is commonly found in April and May. Toads (*Bufo regularis*) and an insectivorous mammal (*Centetes madagascariensis*) destroy large numbers of white grubs, but the latter has almost disappeared from Mauritius since the introduction of the mongoose.

D'EMMEREZ DE CHARMOY (D.). **Notes sur la destruction du** *Phytalus smithi* **en 1927-28.**—*Rev. agric. Maurice*, no. 47, pp. 164–165. Mauritius, September–October 1929.

During 1927–28 the numbers of *Lachnosterna* (*Phytalus*) *smithi*, Arrow, captured in various parts of Mauritius amounted to over 133 millions. In tests with insecticides good results were obtained with calcium cyanide.

ROUBAUD (E.). **Biological Researches on** *Pyrausta nubilalis* **Hb.—II.** —*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 1–21, 1 ref. Chicago, Ill., 1929.

The various lines of research on the biology of *Pyrausta nubilalis*, Hb., of which a preliminary report has been noticed [*R.A.E.*, A, xvii, 210–212], were further developed during 1928 under the three following headings: the attraction exercised by alternative food-plants and the relative preference for maize shown by strains of *P. nubilalis* from different geographical regions; the natural or acquired resistant properties of maize to infestation; and the use of insecticides to protect plants from attack.

In a series of experiments carried out to determine the relative attraction exercised by common mugwort (*Artemisia vulgaris*), hemp (*Cannabis sativa*) and maize (*Zea mays*) on ovipositing moths originating from France, Hungary and Canada, under the same conditions and irrespective of their geographical origin, 14 per cent. of the adult larvae were found on maize and hemp, and 86 per cent. on *A. vulgaris*. The strain from Paris showed an almost exclusive preference for *A. vulgaris*, with a slight attraction to hemp and none to maize, and the Hungarian strain, though coming from a region where the cultivation of maize is intense, showed, in a single experiment, practically the same preference for mugwort as the Paris one. In the case of the Canadian strain, however, maize was apparently as attractive as *Artemisia*, hemp being the least favoured. In a further experiment to determine the relative values of maize and mugwort as food-plants of the Canadian strain, maize was again as heavily infested as mugwort, 87·2 per cent. of the stalks showing more or less severe lesions. In a comparative experiment with Canadian and French strains on maize, only 26·3 per cent. of the maize stalks showed any sign of attack by the French borers, whereas 61·5 per cent. were severely infested by the Canadian strain. Whereas all the mugwort plants used in the experiments in

1927 were completely destroyed, in 1928 three plants suffering from slight infestation had green branches again in the autumn.

It is concluded that there exist geographical types of *P. nubilalis* with distinct preferences as to food-plants that may be termed trophic types. Certain of these manifest a decided attraction to wild plants such as mugwort ; others are less specific in their preferences, and some, like the American borers, are polyphagous. The indifference of the French strain to maize was shown by an experiment in which moths taken from mugwort fields near Paris and placed in a cage with a well-developed maize plant deposited many more eggs on the posts of the cage than on the maize. The Canadian strain was found to be almost equally attracted by mugwort and maize, and will probably prove to be polytrophic, its affinity for the original food-plant being apparently weakened by long absence from it. It is believed that the re-establishment on a large scale of the old associations with mugwort or other detracting plants would weaken the polyphagous tendencies of the American strain.

The results of further experiments confirmed those presented in the last report concerning the spontaneous resistance of certain French varieties of maize under artificial and natural exposure to infestation, and substantiate the fact that the infestation is more severe when a small number of larvae is used. It is now believed that most of the larvae destroyed when a large number is present on one stalk are eliminated through the reaction of self-defence developed by the plant during the infestation. Experiments carried out to prove this theory showed that young larvae of a second infestation were unable to develop on plants still under the influence of the initial attack. An additional series of experiments indicated that this acquired power of resistance to attack by *P. nubilalis* can be inherited in some varieties of maize. More than 97 per cent. of the infestations developing on three varieties of maize originating from parent-plants previously infested with *P. nubilalis* were either slight or not apparent, whereas in the control plants 37·9 per cent. of the attacks were severe.

In continued experiments with insecticide powders against *P. nubilalis*, calcium fluoride proved to be a very effective dust, easy to apply and remaining for a considerable time on the leaves. Further experiments will aim at the application of the dust to the lower surface of the leaves where the eggs are usually deposited and increasing the adhesive quality of the dust under conditions of rain or heavy wind.

Metalnikov (S.) & Chorine (V.). **On the natural and acquired Immunity of** *Pyrausta nubilalis* **Hb.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 22–38, 1 pl., 71 refs. Chicago, Ill., 1929.

In order to determine whether the readiness with which acquired immunity is produced in noxious insects is likely to present insurmountable difficulties in the employment of bacteriological methods for their control, the immunity phenomena of the larvae of *Pyrausta nubilalis*, Hb., have been studied in some detail. An emulsion made from a 24-hour-old agar culture, introduced in varying quantities into 1 cc. physiological salt solution, was injected by means of a pipette in almost exact doses into the larva, and the minimum fatal dose for each bacterium was thus determined. In order to count the bacteria present, blood is taken, by methods which are described in detail, from infected

larvae at regular intervals and examined as stained smears. Microtome sections are prepared in order to study the changes that take place in the tissues of the larvae.

In the first set of experiments various bacteria, recently isolated from diseased larvae of *P. nubilalis* and other insects, were injected in certain quantities of emulsion into the body cavities, and stems of *Artemisia vulgaris* or maize, moistened with bacterial emulsion from a culture on a solid medium, were fed to the larvae. A list is given of 34 species and strains of bacteria, indicating their virulence. Among the more virulent ones, which cause fatal disease when ingested, and are still more virulent by injection, those isolated from *P. nubilalis*, *Galleria mellonella*, L., and *Ephestia kühniella*, Zell., are particularly effective. *Bacterium canadensis* [see next paper], *B. galleriae* no. 2, and *B. thuringiensis* form spores and preserve their virulence for a long period [*cf. R.A.E.*, A, xvii, 213]. The less virulent species cause disease by injection only, and the larvae are resistant to small doses. *Bacillus tuberculosis* can be injected in large quantities without disturbing the larvae, in the bodies of which it is completely digested and destroyed. All the other bacteria investigated showed some degree of virulence to *P. nubilalis*. Further experiments showed that the larvae can easily be immunised against the less virulent bacteria, but cannot, by the usual methods, establish an acquired immunity against the more virulent species.

Those bacteria that do not give rise to phagocytosis are the most virulent and most dangerous to the larvae. They include *Coccobacillus ellingeri*, *Vibrio leonardi*, *Bacterium canadensis*, *B. galleriae* no. 2 and *B. thuringiensis*.

CHORINE (V.). **New Bacteria pathogenic to the Larvae of** *Pyrausta nubilalis* **Hb.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 39–53, 6 figs., 7 refs. Chicago, Ill., 1929.

In continuation of studies on the diseases of *Pyrausta nubilalis*, Hb. [*R.A.E.*, A, xvii, 212], the analysis is presented of 4 new species of bacteria that infect the larvae *per os* and are extremely virulent. These species, which were isolated from larvae from Canada and of which the morphology and cultural characteristics are discussed in detail, are *Bacterium canadensis*, sp. n., *B. ontarioni*, sp. n., *Coccobacillus gibsoni*, sp. n., and *Bacterium christiei*, sp. n. Numerous infection experiments indicate that *B. canadensis* is the most virulent of them, often causing 100 per cent. mortality of the larvae of *P. nubilalis*. The vitality of *C. gibsoni*, which although very virulent does not produce spores, is limited. *B. christiei* and *B. ontarioni* are less virulent than the other species, the latter causing only 50 per cent. mortality when added to the food of larvae of *P. nubilalis*. *B. canadensis* and *B. ontarioni*, when injected into the larvae in a diluted bacterial emulsion, also proved toxic to *Galleria mellonella*, L., and *Ephestia kühniella*, Zell. A very high mortality observed in cultures of very young larvae of *P. nubilalis* in July 1928 was believed to be due to *Micrococcus curtissi*, sp. n., the morphology and cultural characteristics of which are discussed. This micrococcus, which was isolated from the diseased larvae, proved very virulent to mature borers and the larvae of *Ephestia kühniella* when injected, and also infected the borers *per os* to a limited extent. The larvae of *G. mellonella* proved more resistant. Infections *per os* of *P. nubilalis* with *Bacterium thuringiensis*, with

which almost 100 per cent. mortality of the larvae has already been secured [xvii, 219], gave very constant results. This bacterium ranks among those most virulent to the corn borer and appears to be widely distributed. Its morphology and cultural characteristics are discussed.

METALNIKOV (S.) & CHORINE (V.). **Experiments on the Use of Bacteria to destroy the Corn Borer.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 54–59, 3 figs., 4 refs. Chicago, Ill., 1929.

In continuation of previous bacteriological studies of *Pyrausta nubilalis*, Hb. [*R.A.E.*, A, xvi, 288; xvii, 212], an attempt was made to extend the observations to borers infesting maize in the field. The following bacteria were used in the experiments : *Bacterium galleriae* no. 2, *Coccobacillus ellingeri*, *B. canadensis* and two strains isolated from *Ephestia kühniella*, Zell., *Bacterium thuringiensis* nos. 1 and 2, all except *C. ellingeri* being sporulate. The cultures were grown in every case on solid media, as those grown on nutrient broth were found to lose much of their virulence when the broth dried up. In investigations to determine the most effective medium for emulsifying the bacteria, distilled water gave the best results, and was therefore used in the preparation of all the emulsions. The cultures employed were 24–48 hours old in the case of *C. ellingeri* and 5–10 days in the case of the other species. Old cultures of *B. thuringiensis* were more virulent than younger ones. An emulsion from bacterial cultures developed in ordinary tubes was applied at a rather high concentration at the rate of 50 cc. to each maize plant.

Each of 90 maize plants was infested with 50 freshly hatched larvae of *P. nubilalis* 3–10 days after being sprayed with bacterial emulsion, 30 plants having been treated with *B. thuringiensis*, 15 each with the other bacteria and 15 with a mixture of all 4 species. Examination 2–3 weeks after infestation with the larvae showed the earliest signs of activity on the untreated plants, and on those sprayed with *C. ellingeri* and *B. galleriae* no. 2. Plants sprayed with *B. canadensis* showed only slight signs of attack and those treated with *B. thuringiensis* remained quite normal. Even at the end of the season only 5 out of 30 plants sprayed with *B. thuringiensis* showed any indication of infestation. Counts of larvae found when the maize was harvested in September showed an average of 16·7 borers to each untreated stalk, whereas plants of the two series sprayed with *B. thuringiensis* averaged only 1·3 and 1·4 undersized larvae unfit for full development. The larvae from plants sprayed with *B. canadensis* (7·3) or with the bacterial mixture (4·3) were also appreciably smaller than normal. The quality of the grain was also influenced by spraying, the average weight of 100 grains from the unsprayed plants being 30·9 gms., whereas 100 grains from plants sprayed with *B. thuringiensis* averaged 36·6 gms., or almost 20 per cent. more.

METALNIKOV (S.) & CHORINE (V.). **On the Infection of the Gypsy Moth and certain other Insects with** *Bacterium thuringiensis.* **A preliminary Report.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 60–61. Chicago, Ill., 1929.

An account is given of experiments in feeding various species of Lepidopterous larvae on plants moistened with an emulsion prepared from *Bacterium thuringiensis*, from which it is concluded that this

bacterium is very virulent to all the species tested, *viz.*, *Porthetria dispar*, L., *Aporia crataegi*, L., and *Vanessa urticae*, L. This bacterium is also known to be extremely virulent to *Ephestia kühniella*, Zell., and *Pyrausta nubilalis*, Hb. [*R.A.E.*, A, viii, 252; xvii, 219]. In infection experiments *per os* with insects of other Orders, including grasshoppers, mosquito larvae and Bruchids, not a single individual succumbed to infection. It is therefore concluded that *B. thuringiensis* is highly pathogenic to Lepidopterous larvae and that it is specific for this Order.

Ellinger (T.) & Sachtleben (H.). **Notes on the east European Parasites of** *Pyrausta nubilalis* **Hb.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 62–74, 1 pl., 3 figs., 19 refs. Chicago, Ill., 1929.

Parasites of *Pyrausta nubilalis*, Hb., collected in the Ukraine and North Caucasus, where the corn borer has one and two generations a year respectively, are the Tachinid, *Ceromasia* (*Lydella*) *senilis*, Mg., which was also found in Georgia, the Braconid, *Microbracon brevicornis*, Wesm., and the Ichneumonids, *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht., and *E.* (*L.*) *pleuralis*, Thoms. The Ichneumonids, *E.* (*L.*) *fuscicarpus*, Thoms., *E.* (*L.*) *xanthostoma*, Grav., and *Cremastus* (?) *hierochonticus*, Schmied., and the Chalcid, *Trichogramma* sp., were found in the North Caucasus only. The author points out that recent workers are inclined to treat all European forms of *Trichogramma* as belonging to a single species, *T. evanescens*, Westw., but he gives characters in the hairs and size of the front wings by which he considers that at least three distinct forms can be recognised, the Russian corn-bore-parasite being designated form iii. A Chalcid hyperparasite, *Homoporus* sp., was bred from the cocoons of *E. alkae* in the Ukraine. Descriptions of some of these species are given, with notes on their synonymy. This analysis of the first collection of Russian parasites of *P. nubilalis* to be investigated shows the existence within the territory of the Union of Socialist Soviet Republics of several parasites hitherto unknown to attack the corn borer. It is of interest to note that the principal parasites from Central Europe [*R.A.E.*, A, xvii, 220] are present in both the Ukraine and the Caucasus.

Hase (A.). **Report on Corn Borer Experiments 1927-1928. I. On the Migration of young Larvae.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 77–84. Chicago, Ill., 1929.

An account is given of experiments carried out in Berlin in 1927 and 1928 to determine the power of migration of young larvae of *Pyrausta nubilalis*, Hb., in the course of which mature eggs of the corn-borer were placed at marked points in experimental fields of maize in July, and observations made 7–9 weeks later. The larvae recovered in two experiments in successive years represented 41 and 34 per cent. respectively of the total number of eggs. In the first experiment 35 per cent. of the larvae were found within a radius of about 5 ft., and 6 per cent. between 5 and 8 ft. In the second experiment, carried out under less favourable conditions, 30 per cent. of the larvae were recovered within a radius of 3 ft., and 4 per cent. between 3 and $6\frac{1}{2}$ ft. The migration had taken place equally in all directions, and the fact that no plant showed signs of infestation without containing at least one larva indicates that the larvae entered the first plant encountered.

During the critical early weeks of the experiments the average maximum daily temperature was 25° C. [77° F.] in 1927, and 30·2° C. [86° F.] in 1928. The average relative humidity was 73·5 and 56·8 per cent.

Of 80 plants of a different variety of maize (dent de cheval) employed in two further experiments in 1927 and 1928, and each artificially infested with 1–7 newly hatched larvae in the latter half of July, 46 showed signs of attack and 40 contained living larvae. The fact that some of the plants infested with one larva each were later found to contain two is further proof that the larvae migrate. Among the larvae recovered 7 were found in the tassels, 6 in the leaves and 37 in the stalks. The growth of the plants was undisturbed by the presence of the larvae, and this variety was concluded to be unsuitable as a food-plant for the borer.

An experiment was carried out in 1928 in which this and 4 other varieties were artificially infested between 10th July and 1st August, and examined at different intervals. Only about 16 per cent. of the larvae deposited were recovered, the percentage of loss being apparently governed by the duration of the experiment, the weather conditions and the variety of the maize. The variety dent de cheval proved practically immune, less than 1 per cent. of over 4,000 larvae being recovered from it. Two German varieties appear to favour the development of the borer. Neighbouring plants that had not been artificially infested were examined, and it was found that a considerable number of the larvae had migrated to them. Some of the borers used for the infestation, which were of Spanish origin, developed a second generation. Examination of plants of one variety to determine the nature of damage 26–43 days after infestation showed 53 per cent. to be infested in the tassels only, 23 per cent. in the tassels and stalks (including ears), 5 per cent. in the stalks only and 19 per cent. without sign of infestation. A table is given to indicate the movements of the larvae towards the stem away from the peripheral parts of the plant, which dry up first.

Hase (A.). **Experiments with** *Trichogramma evanescens*.—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 85–89, 5 figs., 2 refs. Chicago, Ill., 1929.

A series of experiments carried out in 1927, 1928 and 1929 successfully demonstrated that *Trichogramma evanescens*, Westw., after being bred for 3 years on the eggs of *Ephestia kühniella*, Zell., and *Galleria mellonella*, L., will attack the eggs of *Pyrausta nubilalis*, Hb. Females of *T. evanescens* when offered simultaneously eggs of all three hosts showed no preference for any one of them. *T. evanescens*, which is extremely polyphagous, becomes somewhat smaller when bred on *E. kühniella*, but its vitality is not proportionately reduced. Two parasites develop on an average in each egg of *P. nubilalis*, and in some cases 3, and rarely 4, parasites have been observed within a single egg. The same numbers occur in eggs of *Ephestia* and *Galleria*, but as many as 40–60 normal pupae of the parasite have been found within the large eggs of *Dendrolimus pini*, L.

In an experiment made in 1927 to determine how far *T. evanescens* can migrate from the place of emergence, 16,000 uninfested eggs of *E. kühniella* were distributed among 16 inverted glass bells suspended under a tent at varying distances from a central bell containing 20,000

infested eggs. When, three days after the emergence of the parasites from the latter, all the eggs were brought into the laboratory for observation, only 2·9 per cent. of the originally uninfested eggs were parasitised, although infested eggs were found in all 16 bells. The distance from the central bell to the remotest of the smaller bells was about 5 ft. A second experiment on a smaller scale gave similar results.

Kotlán (A.). **The Corn Borer Situation in Hungary.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 90–98, 1 map, 17 refs. Chicago, Ill., 1929.

This review of the status of *Pyrausta nubilalis*, Hb., in Hungary is mainly taken from the literature and includes a brief history of the production of maize in that country, together with chronological records of infestations by the borer, which have been observed there intermittently from 1871 onwards. During the past two years, infestation has shown a distinct tendency to decrease, owing to the appropriate methods of control advocated or enforced by the government.

In addition to maize, the most common food-plants of the borer are hops (*Humulus lupulus*), millet (*Panicum miliaceum*), hemp (*Cannabis sativa*) and broom-corn [*Sorghum*]. Other food-plants are ragweed (*Ambrosia artemisiaefolia*), mugwort (*Artemisia* sp.), pigweed (*Amarantus retroflexus*), *Dipsacus fullonum, Clematis vitalba* and vines (*Vitis vinifera*). Reeds (*Phragmites communis*) have been found infested in one locality. Although natural infestation of mugwort was found in the southern regions, it was not possible to establish such an infestation even artificially near Budapest. *P. nubilalis* has only one generation a year in Hungary, though a few pupae were found in south-western Hungary on 15th August 1928.

Legislation promulgated for the control of *P. nubilalis* in Hungary since 1917 is briefly reviewed. Measures enforced include: low cutting of all maize stalks after husking (which is done from the standing plants); destruction before 15th May of maize stalks, cobs stubble, dried fodder and broom-corn; prohibition of the use of maize stalks less than one year old for thatching buildings; and the compulsory notification and inspection of all broom-corn cultivated for export. It is estimated that over 70 per cent. of the larvae of *P. nubilalis* in Hungary are destroyed by natural enemies; examination of them during the first 3 or 4 weeks after hatching reveals a much higher degree of parasitism than might be concluded from collections made during the autumn and winter. Parasites found in Hungary are *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht., *Angitia* (*Inareolata*) *punctoria*, Rom., *Microbracon brevicornis*, Wesm., *Eulophus viridulus*, Thoms., *Ceromasia* (*Lydella*) *senilis*, Mg., and an undetermined species, probably *Apanteles* sp., as well as a protozoon, *Nosema pyraustae* [*R.A.E.*, A, xvii, 218], and a Nematode, *Diplogaster brevicauda* [xvii, 248], which is a doubtful parasite. During July an average of 3–5 per cent. of the young larvae in the trans-Danubian zone are infested with *C. senilis*, the most frequent and constant parasite in Hungary, where it has more than one generation a year when the summers are hot. *E. alkae* parasitises 3–6 per cent. of the larvae and is active in all parts of the country. *M. brevicornis*, which is the most inconstant and irregular of the parasites of the corn borer, caused 5 per cent.

parasitism where observed in July 1927 and August 1928, but was only collected once in August 1929. It was found to attack the young larvae of *Vanessa io*, L., at the end of July in southern Hungary. Pathogenic bacteria and fungi seem to play a more limited part in the natural control of *P. nubilalis* in Hungary.

Husz (B.). **On the Use of** *Bacillus thuringiensis* **in the Fight against the Corn Borer.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 99–105, 1 fig., 5 refs. Chicago, Ill., 1929.

Bacillus thuringiensis, the most promising of the bacteria hitherto tried against *Pyrausta nubilalis*, Hb., is a spore-forming bacterium and is thus able to withstand unfavourable conditions. It has been previously shown that the spores lose neither their viability nor their pathogenicity at high temperatures, and during the winter 1928–29, when the temperature in Hungary remained for long periods below 0° C. [32° F.] and registered a minimum of −26° C. [−15° F.], the spores in cultures kept outdoors remained alive and were subsequently transferred successfully to other cultures. Although the bacterium can be grown and has been proved to be pathogenic at ordinary room temperature, one of 30° C. [86° F.] is more favourable to rapid development and quick pathogenic effect. The organism can be easily grown on normal culture media and maintains its virulence without passage through a susceptible host. Spore formation was observed to begin 24 hours after inoculation at 86° F., and the culture consists entirely of spores 6 days later. Young cultures and spore cultures have both proved pathogenic to larvae of *P. nubilalis* fed on them. A spore suspension kept in a closed glass container by O. Mattes was alive at the end of 4½ years, and spores dried at 60° C. [140° F.] had not lost their viability at the end of 6 years.

An account is given of experiments with a number of culture media carried out to discover the best means of producing a highly virulent strain and to ensure the continuous production of the most virulent spores. Cultures on bouillon-agar with peptone and 0·5 per cent. grape sugar at various hydrogen-ion concentrations showed appreciable differences in virulence, those of pH 7·0 or 7·2 proving distinctly more virulent than any others of the series. Field experiments were begun in 1929 with bacteria produced on culture media with pH 7·0, in which maize plants were sprayed with spore suspensions. The concentration used corresponded to the contents of one agar test-tube diluted with 1 litre water, though a preliminary experiment indicated that higher concentrations would be more effective. The cultures employed were at least 6 days old and kept at 86° F. in flat-bottomed glass bottles about 6 inches high, and the spore layer was removed by means of an oil paint brush. The spore material can be equally well dried and carried as powder. Plants were sprayed individually with a hand sprayer throughout the experiments. In an experiment in which a plot of more than 3,000 maize plants were sprayed when the moths were ovipositing (7th July 1929, the season being late), on examination on 22nd September the percentage of injury was 12·89 per cent. as compared with 27·27 per cent. on the untreated plants, and no severely damaged plants were found in the sprayed plot such as occurred elsewhere in the field. A similar experiment, with the spray applied on 24th July when young larvae were present, showed a percentage of

32·7 per cent. infestation on untreated and 19 per cent. on treated plants. The percentage of infested ears on the untreated plot was 13, and in the treated plot 3.

VOUK (V.) & HERGULA (B.). **On some technical Methods applied in Corn Borer Research.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 106–110, 5 figs., 3 refs. Chicago, Ill., 1929.

An account is given of the technique employed in breeding *Pyrausta nubilalis*, Hb. The larvae are made to hibernate in glass tubes 10 cm. long and 8 mm. wide, thus allowing them about as much space as they have in maize stalks, and containing cotton moistened with exactly as much water as the fabric will absorb, to which water must be added from time to time as it evaporates. The tubes are placed in wooden holders in rows of 10, thus facilitating the examination of large numbers of larvae daily and permitting the transference for further observation of parasitised or diseased larvae, which are readily detected. Tubes containing pupae are removed daily, and a week later placed horizontally under metal screen cages, from which the moths are transferred when they emerge to glass containers with a capacity of about 1–2 pts. Cotton moistened with sugar is placed in each glass, which contains 2–3 moths. The eggs are deposited on a piece of black paper placed in the container. When the larvae hatch they are easily visible on the black paper and can be transferred to plants with a fine brush.

For the production of infestations of individual plants, gauze cages are placed over them, with pointed feet 8 inches long fixing them firmly in the ground. Two or three pairs of moths are then liberated within, and observations are made of the eggs deposited. When it is desirable to regulate the number of eggs, egg-clusters deposited in the laboratory are cut out from the black paper and pinned to the leaves of maize plants after the number of eggs has been counted.

HERGULA (B.). **Insect Parasites of the Corn Borer in Northern Jugoslavia.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 111–127, 12 figs., 10 refs. Chicago, Ill., 1929.

As the result of observations made in the Danube basin in northern Jugoslavia, a brief survey is given of the infestation of maize by *Pyrausta nubilalis*, Hb., in 1928, which was on the whole lighter than that in 1927, the percentage exceeding 50 only in one locality. The figures from the east, where infestation often reaches 90 per cent., varied from 1·6 to 20·2, the persistent drought probably accounting for both the reduced maize crop and the low percentage of infestation. Only one case of the production of a small partial second generation was recorded [*cf.* *R.A.E.*, A, xvii, 219].

The parasites recorded are the Ichneumonids, *Eulimneria* (*Limnerium*) *alkae*, Ell. & Sacht., and *Angitia* (*Inareolata*) *punctoria*, Roman ; the Braconids, *Microbracon brevicornis*, Wesm., and *Macrocentrus abdominalis*, F. ; the Chalcids, *Eulophus viridulus*, Thoms., and *Trichogramma evanescens*, Westw. ; and the Tachinids, *Ceromasia senilis*, Mg., and *Zenillia roseanae*, Br. & Berg. *M. abdominalis*, *E. viridulus*, *T. evanescens* and *Z. roseanae* are recorded for the first time from Jugoslavia. *E. alkae*, *A. punctoria* and *C. senilis*, the more important of the parasites found, together destroyed 9·5 per cent. of the larvae of *P. nubilalis* in the material collected in 1928–29.

E. alkae hibernates in the pupal stage, the adults emerging in March or April. There is ordinarily only one generation a year, but empty cocoons were found in the autumn of 1928, indicating that a second generation may develop. How this parasite spends the time between the emergence of the adult in the spring and the appearance of *P. nubilalis* in July is unknown, and the theory of an intermediate host has not been proved. In some cases hyperparasites were obtained from the cocoons of this Ichneumonid. *A. punctoria*, hitherto believed to be rare in Jugoslavia, has been found to be widely distributed there, and is even the most important parasite in some localities. The pupal stage in the field lasts 14–18 days. Pupation takes place from mid-May to early July, the adults emerging from mid-June to mid-July. Adults of *Angitia* and *P. nubilalis* are thus found simultaneously in flight. The parasite has only one generation a year in Jugoslavia, hibernating in the first larval instar within the body of the host larva.

The females of *Microbracon brevicornis*, which caused 2·8 per cent. parasitism of the corn borer in one locality in 1928, paralyse and kill many larvae without using them for oviposition. The adults were observed at the beginning of August, and at the end of the month a new generation developed. Dead corn borers surrounded by the white silk of the parasite larvae were found in the winter in old maize stalks from the same locality. The egg stage lasts 29 hours, the larval stage 78 hours and the pupal stage 10 days. The adults live about 10 days in the laboratory. *Macrocentrus abdominalis*, which is new to the central European maize belt, has been recorded from two localities, where it caused 1·6 and 0·4 per cent. parasitism respectively. The larvae emerged from their hosts between the end of May and the end of June, during the pupation period of *P. nubilalis*. They remain in a cluster for a few hours on the skin of the host, feeding as ectoparasites. If removed immediately after emergence, they usually die. The larvae spin a common cocoon around themselves and the host, and afterwards an individual cocoon within the former. The pupal stage lasts 15–19 days, so that the adults emerge in late June or early July, when *P. nubilalis* is on the wing. All individuals from one host are always of the same sex, indicating a polyembryonic development.

The hibernating pupae of *Eulophus viridulus*, which is recorded from 4 localities, causing degrees of parasitism varying from 2 to 0·3 per cent., were found in the tunnels of *P. nubilalis* on or near the remains of dead larvae. The number of parasites developing from each host varies from 4 to 29. The adults emerge in April and the beginning of May. Every egg in clusters attacked by *T. evanescens* collected in Zagreb in 1929 was found to be parasitised, two parasites developing from most of the host eggs.

A description of the male of *Ceromasia senilis* by Baranoff and the author is quoted, and a corresponding description of the female by Baranoff is given. The percentages of parasitism caused by it in 13 localities are recorded, the average being 5·9, and the maximum 29·7. *C. senilis* hibernates within the host as a second instar larva, and emerges from it in late winter or early spring. The puparium is formed in the tunnel of *P. nubilalis*, two parasites emerging in many cases from one host. In such cases one parasite is normal, the other small. In one case 3 parasites were present. The pupal stage lasts 3 weeks in the field, pupation taking place in late March and April. The adults appear at the end of May, the males being in the majority at first and later the females. The mating habits are described.

The manner in which the parasite passes the time between the emergence of the adult in the spring and the appearance of *P. nubilalis* in the summer is unknown ; no data are available to support the theory of an intermediate host. There is usually only one generation a year in connection with *P. nubilalis*, but empty puparia have been found in the tunnels of the latter, indicating that some of the parasites do not hibernate within the host but develop the same year. Only 3 specimens of *Zenillia roseanae* have been bred from the larvae of *P. nubilalis*, including 2 from southern Croatia. In Italy and southern France this parasite is two-brooded. In Jugoslavia it has been bred from *Mecyna polygonalis*, Hb.

A Chalcid agreeing with Masi's description of *Eupteromalus nidulans*, Thoms., was bred from puparia of *Ceromasia senilis* in 1929. It is not, however, identical with the species regarded as *E. nidulans*, (Först.) Thoms., by other authors, which is a parasite of Lymantriids and *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhea*, auct.), and has been imported into the United States [*R.A.E.*, A, xii, 171 ; xv, 671]. From 8 to 16 specimens were observed to emerge from the puparium of the host. The adults lived 7 days without food and 22 days on sugar and water in the laboratory.

A table is given showing the percentage of parasitism for each species for each locality, as well as the total percentage of parasitism for the season 1928–29.

BARANOFF (N.). **A Contribution to the Morphology of the Tachinid Flies bred from** *Pyrausta nubilalis* **Hb.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 128–130, 3 figs. Chicago, Ill., 1929.

In order to facilitate their classification in the Tachinid system, an analysis is given of the sternites and genitalia of both sexes of *Ceromasia* (*Masicera, Lydella*) *senilis*, Mg., and *Zenillia roseanae*, Br. & Berg.

The author considers it practical to apply the specific names more commonly used in modern literature, and follows Lundbeck in respect of the generic names.

WALLENGREN (H.) & JOHANSSON (R.). **On the Infection of** *Pyrausta nubilalis* **Hb., by** *Metarrhizium anisopliae* **(Metsch.) Sor.**—*Internat. Corn Borer Invest. Sci. Rep.*, ii, pp. 131–145, 15 figs., 11 refs. Chicago, Ill., 1929.

In experiments carried out in 1928 to study the infection of the larvae of *Pyrausta nubilalis*, Hb., by various entomophytic fungi, the best results were obtained with *Metarrhizium anisopliae*. An account is given of the culture of this fungus for the purpose of infecting the larvae and a series of experiments carried out on hibernating 5th instar larvae. The various methods of producing infection may be divided into two main groups, wet and dry. By the wet method the larvae were either dipped twice in water in which conidia were suspended, or the conidia were stirred with boiled rice or agar and the mixture spread on the skin of the larvae. By the dry method the larvae were kept on a dry filter paper at the bottom of a basin or glass tube and powdered with dry conidia. Experiments were also made in which a larva infected by either method was placed in a basin or

tube in which were uninfected larvae. Conidia were also introduced into the stems of different food-plants in which the larvae of *P. nubilalis* are known to hibernate. Infection was produced with equal ease by all these methods. The larvae were found to succumb more quickly in an atmosphere saturated with moisture. In such an atmosphere they were observed to survive 6 days at a temperature of 18–20° C. [64·4–68° F.] and only 4 days at a temperature of 25° C. [77° F.]. No larvae in which the conidia had pierced the skin survived more than 26 days. An account is given of the structure of the skin of the larva of *P. nubilalis* and of the growth of *Metarrhizium anisopliae* into the chitin.

[Kluyver (H. N.).] **Rupsenplagen. Bastaardsatijnvlinder, plakker, ringelrups, satijnvlinder en spinselmot.** [Caterpillar Pests. *Nygmia phaeorrhoea*, Don., *Porthetria dispar*, L., *Malacosoma neustria*, L., *Stilpnotia salicis*, L., *Hyponomeuta malinellus*, Zell., and *H. padellus*, L.]—*Versl. & Meded. Plantenz. Dienst*, no. 59, 28 pp., 7 pls. Wageningen, December 1929.

Each of these pests is dealt with separately, the larva and adult being described, with special attention to the stage against which control measures are directed or the presence of which indicates the need for their application, and notes on the measures required. A special chapter is devoted to co-operation in spraying and in bird-protection.

Braune (R.). **Untersuchungen an *Niptus hololeucus* Fald. Teil I: Morphologie und Biologie.** [Investigations on *N. hololeucus*. Part I: Morphology and Biology.]—*Z. Morph. Oekol. Tiere*, xvi, no. 1–2, pp. 234–370, 56 figs., 2 pp. refs. Berlin, 17th December 1929.

The eggs of *Niptus hololeucus*, Fald., are laid at all seasons of the year, and the larvae hatch in 15–17 days. There are normally two moults, but the length of the larval stage varies considerably, depending on temperature and food. The pupal stage lasts 16–18 days. The adults feed normally on animal matter, as do the larvae, preferably on dead insects, but they also attack articles of clothing soiled with grease, etc.

Rozsypal (J.). **Květopas ostružníkový** (*Anthonomus rubi* **Hbst.**).—*Ochrana Rostlin*, ix, no. 5–6, pp. 128–132, 4 figs. Prague, 1929.

Notes are given on the bionomics of *Anthonomus rubi*, Hbst., which was abundant on strawberries in Czechoslovakia in 1929 and also infested blackberries and roses [*cf. R.A.E.*, A, xvii, 403, 700]. All stages are very briefly described. The eggs hatched in 7 days and the larval stage lasted 28. Young adults occurred throughout June and July, and larvae were subsequently observed on raspberries, so that it is possible that there are two generations a year, though this has not been proved.

Phyllobius viridicollis, F., was also numerous on strawberry.

[BAĬLOV (D.).] **Байлов (Д.). Beitrag zur Erkenntnis des Kampfes gegen den Tabakblasenfuss in Bulgarien.** [Contribution to the Study of the Control of Tobacco Thrips in Bulgaria (*in Bulgarian*).]—*Rev. Insts. Rech. agron. Bulgarie*, iv, pt. 4–5, pp. 21–86, 4 figs., 26 refs. Sofia, 1929. (With a Summary in German.)

Observations on *Thrips tabaci*, Lind., were carried out in 1927–28 in south-western Bulgaria, where tobacco is an important crop. The damage caused by the thrips is discussed in detail; both the quality and quantity of the crop is seriously affected, the losses amounting to 30–50 per cent. of its value. Infestation occurs wherever tobacco is grown, at altitudes ranging from 300 to 3,300 ft., under high or low degrees of humidity, and in soils of varying composition. Control is particularly difficult as the thrips feeds on a wide range of weeds, grasses and cultivated vegetables.

Such measures as autumn and spring ploughing to kill the eggs, the destruction of weeds that harbour the hibernating adults, larvae and pupae, the burning of débris in the tobacco fields after the harvest, transplantation of uninfested plants, etc., might be effective if carried out simultaneously in large areas, but cannot be applied in Bulgaria under present conditions. Efforts to obtain varieties of tobacco immune from infestation should be organised on a large scale. Experiments were made with various insecticides, but in general, sprays and dusts do not reach the thrips owing to the hair on the leaves; they also seriously affect the quality of the tobacco.

The predacious Anthocorid, *Triphleps nigra*, Wolff, appears to be of considerable importance as a natural enemy of *Thrips tabaci*, its numbers being usually directly proportionate to those of the thrips. It was found wherever the latter occurred. A detailed description of the adults and larvae is given, and the manner in which the former feed on the thrips is described. The bugs usually migrate in the evening to weeds and grasses infested by the latter, preferring *Amarantus retroflexus*, *Mentha* and clover, and return to tobacco in the morning. The immature stages do not occur on tobacco. Both larvae and adults are polyphagous and attack a variety of insects and mites. Hibernation occurs in the adult stage on dry plants, in hedges, etc., and oviposition begins in May and reaches its height in August. The females lay large numbers of eggs, which hatch in about 8 days, the adult stage being reached about 4 weeks later. No cannibalism was observed under conditions of starvation or crowding, and no parasites were recorded. Care should be taken not to destroy the bugs, and the weeds on which they chiefly breed should not be cut down. It is possible that their numbers might be increased artificially, and preliminary experiments in breeding them are described.

[LAPPIN (G. I.).] **Лаппин (Г. И.). The Locust in the Kuban Region and Measures for its Control.** [*In Russian.*]—[*Publ.*] *Kubansk. Sta. Zashch. Rast.*, Ser. A, no. 2, 42 pp., 3 figs. Krasnodar, 1929.

The flood areas of the Kuban delta serve as permanent breeding areas for *Locusta migratoria*, L., serious outbreaks of which occurred in 1886 1893–95, 1905 and 1920–25. During the summer of 1927 numerous swarms of locusts were again recorded in the Kuban Province, and in the autumn of that year oviposition had occurred over an area of

54 sq. miles. In the summer of 1928 most of the locusts that appeared in the infested area were destroyed. However, in September 1928 immense swarms appeared in the Kuban Province, flying from the Sea of Azov in a south-easterly direction, and in the autumn, egg-deposits occupied 150 sq. miles.

The author considers that the increase in the numbers of locusts during the last few years has been mainly due to the dry weather generally prevailing since 1925 and to a partial drainage of the flood areas carried out during the last 5–6 years. Before this time, autumn egg-deposits on low-lying ground were flooded for a considerable period during the next spring, and the eggs thus perished. The newly drained areas, which no longer become flooded and are overgrown with reeds, provide very suitable breeding grounds for the locusts, which consequently multiply to a greater extent than formerly.

Detailed instructions for organisation of control by the usual methods are included.

[Antonov (N.V.) & Kulik (A. A.).] **Антонов (Н. В.) и Кулик (А. А.). Les explorations des réservations du criquet pélerin** (*Locusta migratoria* **L.**) **dans la région du lac Zaisan-Nor à Kazakstan.** [*In Russian.*]—8vo, 26 pp., 4 figs. Kzuil-Orda, Kazaksk. kraev. Sta. Zashch. Rast., 1927. Price, 60 *kop.*

This is an account of an expedition sent to lake Zaisan-Nor, Kazakstan, in 1925 to study the permanent breeding-places of *Locusta migratoria*, L. Several such areas were found on the sandy shores of the lake, overgrown with *Agropyrum repens* and separated from the water by immense beds of reeds, which appear to serve as the principal food-plant of the locusts. Later in the season the reed-beds become flooded by the rising water of the lake, but the locusts remain on the reeds.

Some control experiments with poison baits were made with good results. The following new method proved very successful. Parallel paths were cut between densely growing reeds in front of an advancing swarm, and the newly mown reeds lying along them were sprayed with arsenic (2 lb. to 3 gals. water) ; these were readily eaten by the locusts as soon as they reached them.

Historical data on the occurrence of locusts at Zaisan-Nor between 1885 and 1924 are included.

[Korol'kov (D. M.) & Savenko (R. F.).] **Корольков (Д. М.) и Савенко (Р. Ф.). The Olive Moth** (*Prays oleellus* **Fabr.**), **its Life-history and Control.** [*In Russian.*]—8vo, 25 pp., 8 figs., 2 refs. Sukhum, Abkhazsk. opuitn. sel.-khoz. lesn. Sta., 1929. (With a Summary in English.)

A detailed account is given of observations in 1928 and 1929 on the bionomics of *Prays oleellus*, F., near the town of Sukhum (Georgia), where this moth is an important pest of olives, which are extensively grown. There are three generations a year. The overwintered larvae feed on the leaves until the end of April or beginning of May, when they pupate on the lower surfaces or between two leaves spun together. The moths emerge after 8–9 days ; in 1929 they were on the wing throughout the second half of May. The period of pupation and emergence is usually protracted, as the larvae do not emerge from hibernation or complete their feeding simultaneously. In 1929

oviposition began on May 20th, the eggs being laid singly on the calyces of the flower buds, one to each bud; a few are laid on the upper surface of the old leaves. The larvae hatch in 7–8 days and immediately eat into the buds, where they feed on the pistils and stamens; they migrate from bud to bud, webbing them and the flowers together, but do not usually attack the open flowers. Retarded individuals complete their feeding on young soft leaves after the flowering period is over. As the infested buds do not set, the loss of crop caused is very serious. Pupation usually occurs among the flowers and buds on which the larvae feed, and sometimes on the lower surface of the leaves, the pupal stage lasting 7–8 days. The emergence of the adults takes place from about the second half of June till the middle or end of July, and oviposition continues for about a month. The eggs are laid chiefly on the calyces of the fruits but sometimes on the leaves; as many as 12 may be deposited on each fruit. The larvae hatch in 6–7 days, passing through the egg-shell into the fruit and making their way to the stone. Only one enters the stone and develops; the others return to the surface of the fruit and subsequently die. The infested olives begin to fall early in September, when the larvae abandon them for pupation. Many of the fruits still harbour the larvae when they fall, but these emerge within 24 hours and continue to feed on the surface. Pupation usually occurs on the lower surface of leaves either on the trees or on the ground. The adults emerge in the second half of September and oviposit at the end of the month or beginning of October, usually on the upper surface of the leaves. The larvae mine the leaves and migrate from one to another, hibernation occurring in the galleries. The larvae of the first and second generations that hatch from eggs laid on leaves feed on the parenchyma throughout the summer and autumn, their development being considerably retarded; they hibernate in the leaves, and together with those of the third generation resume feeding in January or February on the surface.

The parasites of *P. oleellus* are of little importance, though several unidentified Chalcids and Ichneumonids were reared by the authors, and a mite of the genus *Trombidium* was observed attacking the overwintered larvae in spring.

Control measures suggested include improved cultivation of olive trees, prompt removal of fallen fruits and foliage while they still harbour the larvae and pupae respectively, and protection of insectivorous birds. Studies should be made on the selection of resistant varieties of olive. In experiments, sprays of 1 lb. sodium arsenite and 1 lb. zinc oxide to 100 gals. water killed a considerable number of larvae and did not scorch the leaves, which were, however, injured when the amount of zinc oxide was halved. Many larvae were killed by sprays of 1 lb. Paris green and 1 lb. zinc oxide to 75 gals. water, or 1 lb. lead arsenate to 60 gals., and the foliage was not affected. In view of the frequent rains in spring, the authors recommend the application of three sprays at intervals of 7–10 days, starting as soon as the overwintered larvae appear on the leaves.

Hutson (J. C.) & others. **Reports on Insect Pests in Ceylon during 1928.**—24 pp. [in] *Tech. Rep. 1928 Dept. Agric. Ceylon.* Colombo, 1929.

Much of the information on insect pests contained in the reports of the Entomological Division and the Plant Inspectors has already

been noticed from other sources. Specimens sent in for examination and report include: *Narosa conspersa*, Wlk. (gelatine grub) on tea; *Autoserica mollis*, Wlk., and *Microtrichia costata*, Wlk., on the shoots of budded rubber; mole crickets (probably *Gryllotalpa africana*, P. de B.) on the roots of rice; *Prodenia litura*, F., on the leaves of cotton; *Myllocerus* sp. on grapefruit; *Icerya aegyptiaca*, Dougl., on pomegranate (*Punica granatum*); *Calotermes* (*Neotermes*) *militaris*, Desn., on dadap (*Erythrina lithosperma*); *C.* (*Glyptotermes*) *jepsoni*, Kemner [MS.], on *Albizzia moluccana*; *Dichomeris ianthes*, Meyr., on *Indigofera hirsuta*; *Pyrops dohrni*, Stal, on *Desmodium heterocarpum*; *Thosea aperiens*, Wlk., on the cover crop, *Dunbaria heynei*; *Parasa lepida*, Cram., on *Acalypha* sp.; *Lachnosterna* (*Holotrichia*) *serrata*, F., on *Canna*; and *Zeuzera coffeae*, Nietn., in a branch of *Chickrassia tabularis* and in a stem of *Hydnocarpus wightiana*.

Reports on termites attacking various economic plants [*R.A.E.*, A, xvii, 568] and on those attacking buildings [xvii, 543] are contributed by F. P. Jepson. Tables are given showing the distribution of *Calotermes* in Ceylon and the recorded food-plants of each species. Evidence has been obtained that the immature stages of *C.* (*Neotermes*) *militaris* can enter the roots of tea bushes from those of infested plants with which they are in actual contact.

Serious outbreaks of nettle grubs occurred on tea during the early months of 1928, and investigation showed that *Natada nararia*, Moore, *Spatulifimbria castaneiceps*, Hmps., and *Thosea cervina*, Moore, were chiefly responsible for the damage. One of the most effective natural factors controlling *Natada* is the so-called wilt disease, but it only becomes prevalent in heavily infested areas where food shortage and overcrowding lower the vitality of the larvae. Moreover, there are always some individuals that are immune or resistant to the disease. The cocoons of *N. nararia* are usually formed among fallen leaves or other rubbish beneath the bushes or on the growing leaves and twigs; but during a series of severe attacks on the same area, large numbers were formed on the surface of the soil under infested bushes, and daily collections proved to be a practicable method of control. The collection of larvae is also advocated. During heavy rains the larvae left the tea bushes and congregated in large numbers on the lower surface of the leaves of inter-planted dadap. The removal of the large leaves from this plant during the wetter months of the year deprived the larvae of shelter and they returned to the tea, from which they could be more easily collected. *Natada* is known to feed on about thirty different species of wild and cultivated plants growing in or near tea fields, and it is suggested that the periodical burning of scrub during periods of drought would destroy the immature stages.

Inspection of most of the important banana areas of the Island revealed the presence of *Pentalonia nigronervosa*, Coq., in all of them. In one locality no bunchy top was detected although the Aphid was present.

Experiments on a Eulophid parasite of *Nephantis serinopa*, Meyr., prove that it attacks the pupae only. The adults emerged 17 days after the parasitism of the host, and lived 12 days when kept in captivity and fed on sugar solution. Field observations indicate that this parasite may disappear almost completely during periods of drought, but under more favourable conditions gradually regains complete control of the pest in any given area. For this reason artificial control measures are only instituted where inspection has shown

that the parasite is unlikely to regain control at an early date [*cf.* *R.A.E.*, A, xv, 219].

The females of *Argina argus*, Koll., lay from 250 to more than 1,000 eggs on the young shoots of various species of *Crotalaria*. The larvae hatch in 4–5 days and reach maturity in about 3 weeks. They feed in masses on the young leaves, bore into the pods and sometimes injure the bark so severely as to kill the plants. The pupae are slung in a loosely woven web or formed within the fold of a leaf, and the moths emerge in about 10 days. Under laboratory conditions the caterpillars were successfully controlled by spraying the leaves with 1 lb. sodium silicofluoride to 25 gals. water without injury to the foliage. In the early stages of an attack the young larvae can easily be collected. In several instances *Ceroplastodes cajani*, Mask., was found on *Tephrosia candida*; it spreads from the young shoots down the main stem and may kill the young plants. Sometimes it is controlled by natural enemies before serious injury occurs; otherwise infested branches should be lopped and burned, and attacked areas manured, all heavily infested or dead plants being destroyed. As a green manure, *T. candida* should be grown for preference in alternate rows for not more than two years at a time, after which it becomes woody and liable to attack. It should then be taken up, and the rows previously left vacant should be planted with fresh seed.

Experiments with beans (*Phaseolus*) and cowpeas (*Vigna*) indicated that although no variety was completely immune from attack by the bean fly (*Agromyza* sp.), the degree of resistance varied considerably. With regard to pests of sweet potato (*Ipomoea batatas*), the larvae and adults of *Aspidomorpha furcata*, Thnbg. (tortoise beetle) attack the leaves of this and other species of *Ipomoea*. The egg-cases, which contain an average of four eggs, are usually attached to the lower surface of the leaves. The females may live for 4 months and oviposit every day. The larvae hatch in about a week and pupate about three weeks later, the pupae being attached to the leaves. The beetles emerge in about 2 weeks and begin to oviposit within 3 days. In the insectary the eggs of *Tabidia aculealis*, Wlk., are laid on the leaves and hatch in about 6 days. The young caterpillars feed within a fold, usually a single caterpillar to a leaf. Pupation takes place in about 3 weeks, and the moths emerge in about 2, oviposition beginning within 3 days. Under field conditions the larvae are efficiently controlled by a Braconid parasite. The larvae of *Lamprosema poeonalis*, Wlk., also skeletonise the leaves. The eggs are laid on the stems and the lower surface of the leaves and hatch in about 6 days. The larvae, which readily drop to the ground when disturbed, are full-grown in about a month and pupate within the folds of leaves on the ground. The moths emerge in about 10 days. No parasites have been observed. These three pests can be controlled by spraying the leaves thoroughly with "super-arsenate of lead" at the rate of 1 lb. to 50 gals. water. Sodium silicofluoride (1 lb. to 25 gals.) gave effective control, but scorched the foliage. Injury to tomatos first noticed during 1927 was found to be due to larvae of *Heliothis obsoleta*, F., which is recorded for the first time from Ceylon.

It is pointed out that damage by *Oryctes rhinoceros*, L., is not likely to be reduced while regulations permit the stems of coconut palms to be used for bridges over drains, depressions, etc., as breeding-places are thus established throughout estates. The beetles also breed in

fence posts and in the thick parts of midribs of coconut leaves when the latter are buried in light soils.

Among the less well known pests mentioned in the Inspectors' Reports are *Menida histrio*, F., *Tettigoniella spectra*, Dist., and *Pachydiplosis oryzae*, Wood-Mason, on rice. *T. spectra* was heavily infested by an unidentified fungus. In one locality *Dysdercus cingulatus*, F. (red cotton bug) was attacked by *Antilochus nigripes*, Burm.

WILKINSON (H.). **The Coffee Berry Borer Beetle,** *Stephanoderes hampei* (**Ferr.**).—8vo, 10 pp., 2 pls. Nairobi, Govt. Printer, 1928.

In view of the recent discovery of *Stephanoderes hampei*, Ferr., in Kenya [*R.A.E.*, A, xvii, 625], the author has compiled an account of the bionomics of the insect and the remedies practised against it in other countries.

SMEE (C.). **Insects in Tobacco Seedbeds.**—*Bull. Dept. Agric. Nyasaland*, Ent. Ser., no. 5, 8 pp. Zomba, January 1929.

Most insects in tropical countries aestivate during any prolonged dry season. They are active for the longest periods in areas that remain moist for the longest time, such as the vicinity of streams. Tobacco seedbeds must be situated in such areas, and the moist conditions necessary for the seedlings are suitable for the activity of the numerous insects. In Nyasaland colonies of *Pheidole megacephala*, F., are present in the soil all the year round, and as a direct result of the watering of the seedbeds, the ants appear on the surface. They are omnivorous, and as there is an absence of other nourishment, owing to the burning to which the seedbeds are subjected, the ants collect the tobacco seeds and taken them to their runways. Powdered mercury bichloride sprinkled round the runways gives satisfactory control, but is too expensive for general use. As the seeds are not removed once they become rooted in the earth, the sowing of germinated seed has been suggested, but this method does not entirely eliminate the loss caused by the ants, and the germinating points may be injured in the process. The use of a poison bait is therefore recommended. The carrier should consist of particles sufficiently fine for the ants to remove without difficulty, and fresh seed should not be sown for three days after the application of the bait.

The larvae of *Euxoa segetum*, Schiff., and *E. longidentifera*, Hmps., also cause damage in the seedbeds. The moths, which are only active at night, usually remain close to the ground and lay their eggs singly on stones and sticks as well as on the plants themselves. One female may deposit some 1,500 eggs. The young larvae hatch in a short time and feed on the plants during the day ; the older ones feed at night, eating into the plant stems at about ground level. Pupation takes place in the soil 30–35 days after the eggs are laid. The duration of the pupal period is variable, being about 15 days early in the season. The larvae are most voracious just before pupation, a stage that lasts 7–10 days, and one may then destroy 2 or 3 plants in a night, so that serious losses occur if they reach this stage of development when the plants are almost ready to be set out. Cloth covers for the seedbeds prevent the deposition of eggs, but as the moths remain as close as possible to the ground, care should be taken to adjust the edges.

Hand collection of the larvae is generally the most economical method of control, but in severe infestations a succulent poison bait may be used against the older larvae, or the plants may be sprayed with an arsenical against the young larvae while they are still feeding on the leaves. As it is difficult to know when eggs have been laid, such spraying should be carried out as a regular practice every 4–10 days.

Other Lepidopterous larvae are constant pests of greater or less importance in the seedbeds. The eggs of *Prodenia litura*, F. (tobacco caterpillar) are deposited on the leaves or some object nearby, several batches of 60–200 being laid by each female. The young caterpillars feed gregariously on the leaves, but the older ones live singly and may attack the stems as well. They may spend a considerable amount of time on or near the ground and pupate in earthen cells, from which the adults emerge after a variable period (about 10 days in the early part of the season). The eggs of *Phytometra limbirena*, Guen., *P. orichalcea*, F., and allied moths are laid singly, usually on the lower surface of the leaves. The caterpillars feed on the leaves, where they pupate in silken cocoons. The larvae of *Hippotion celerio*, L., the eggs of which are laid singly on the leaves, are not often found in nurseries, but owing to their size are capable of causing considerable damage, small plants being completely destroyed in a very short time. Measures against them are similar to those against cutworms.

The females of *Phthorimaea heliopa*, Lw., lay about 100 eggs, usually at night. If these are laid on the leaves, the young larvae mine into the midrib and down through the leaf stalk into the stem ; if they are laid directly on the stem, the larvae bore into the plant tissues. There is usually only one caterpillar to each plant. They pupate within the swollen stem, and the adults emerge 9–10 days later. There is a succession of overlapping generations. The normal food-plants of this moth are various solanaceous weeds, frequently found on the banks of streams. Infested plants should not be set out in the field, as their growth is never satisfactory, but it is sometimes possible to cut back the plants below the galls so that fresh growth can be made.

Serious outbreaks of grasshoppers and crickets do not often occur in seedbeds, but these insects always cause a certain amount of damage. *Chrotogonus vendalli*, Kirby (toad locust) is active for almost the entire year. The egg-pods are usually laid in soil bare of vegetation. The greatest damage is caused to very young tobacco plants in the early part of the nursery season. The egg-pods of *Zonocerus elegans*, Thnbg., are usually placed under bushes or in long dry grass. Owing to the size and voracious appetite of the adults, they cause considerable damage to the larger plants. Adults of *Gryllotalpa africana*, P. de B., are attracted to the seedbeds because they prefer soil with a certain amount of moisture in which to construct the burrows in which they oviposit and usually shelter during the day. The greatest damage by these mole crickets is probably caused to the underground parts of the plant during the construction of burrows and runways. *Oecanthus pellucens*, Scop. (tree cricket), which lays its eggs in plant stems, tree shoots, etc., spends its life above ground and can cause serious damage to tobacco by gnawing holes through the young unfolded leaves in the heart of the plant. Baits and sprays may be used against these pests. The removal of bushes and long grass from the vicinity of the beds renders conditions unsuitable for the oviposition of *Z. elegans*.

The following poison baits are recommended for use against pests in seedbeds: 20–25 lb. bran or other carrier moistened with $\frac{1}{2}$ gal.

molasses or 4 lb. sugar dissolved in 1 gal. water and thoroughly mixed with 1 lb. Paris green ; or about 100 lb. carrier thoroughly wetted with 1 lb. sodium arsenite and 1 gal. molasses or 8 lb. sugar dissolved in about 8 gals. water. They should be applied at sunset, the Paris green bait at the rate of about 50–100 lb. per acre. That containing sodium arsenite should only be used on bare ground, as it causes severe scorching on plants. Sprays recommended are 3–8 oz. lead arsenate powder or 1–2 oz. Paris green in 16 gals. water or Bordeaux mixture (the greater strength of lead arsenate is usually most suitable for seed beds, but the weaker may be used against very small caterpillars).

Ripley (L. B.) & Hepburn (G. A.). **Stalk-borer in Maize. Effect of Top-dressing.**—*Fmg. S. Afr.*, reprint no. 59, 4 pp. Pretoria, October 1929.

In further tests in the control of the stalk-borer [*Busseola fusca*, Fuller] by insecticides applied to the tops of the maize plants [*cf.* *R.A.E.*, A, xvi, 689], satisfactory results were obtained with kymac (a sheep dip containing derris), 1 : 250, and suspensions in water of cryolite and pulvex, 1 : 600 and 1 : 540 by weight, respectively. Pulvex as now made consists of derris extract absorbed in an inert powder ; it proved more effective than a preparation containing ground derris root. It did not scorch the plants at all, whereas cryolite and kymac did so slightly, though probably not enough to reduce the yield. Cryolite is the cheapest of the three materials and has the additional advantage of acting as a stomach poison, so that larvae that are not actually hit by it may be killed. The best device for applying the liquids is a light metal knapsack with a rubber tube leading from one of the lower corners. Each plant should receive about a dessert-spoonful of the liquid.

Davis (J. J.). **Insects of Indiana for 1928.**—*Proc. Indiana Acad. Sci.*, xxxviii (1928), pp. 299–314, 9 figs. Indianapolis, Ind., 1929.

Brief notes are given on a considerable number of insect pests recorded in Indiana in 1928.

McDonnell (C. C.) & Graham (J. J. T.). **Deterioration of Soap-Nicotine Preparations. ii.**—*Indust. Engng. Chem*, xxi, no. 1, pp. 70–73. Easton, Pa., January 1929.

Following the investigations previously noticed [*R.A.E.*, A, xiii, 239], further study has been made of the deterioration of soap-nicotine preparations, including work with soaps made from different types of oils, both drying and non-drying. The results are summarised as follows : Soap-nicotine preparations ordinarily found on the market decrease in nicotine content on storage. Hard soda soaps lose nicotine more rapidly on exposure to the air than potash soaps. However, soft soda soaps and potash (soft) soaps lose it at about the same rate. Excess of alkali or fat in the soaps has no appreciable influence on the rate of loss of nicotine. The loss of nicotine from soap-nicotine preparations made with drying oils (fish oils, cottonseed oil, linseed oil) and packed so that air is not excluded is due mainly to oxidation, the nicotine with part of the fatty acids of the soap being converted

into an insoluble condensation product of indefinite composition. The loss of nicotine from soap-nicotine preparations made with non-drying oils (oleic red oil, stearic acid) and stored without air being excluded is due to volatilisation of nicotine, no insoluble condensation product being formed. Both hard and soft soaps, whether made from drying or non-drying oils, when packed so that they were completely protected from the air, suffered no loss in nicotine content during two years of storage.

HART (R.). **A Study of Water-miscible Mineral-oil Preparations, textile Oils, leather Oils, metal-cutting Oils, etc.** —*Indust. Engng. Chem.*, xxi, no. 1, pp. 85–90. Easton, Pa., January 1929.

The following is the author's summary: It is shown that the manufacture of clear water-miscible or "soluble" mineral oils is primarily a problem in miscibility, and that free oleic acid is essential to a uniform product. Miscibility curves for several emulsifiers, mineral oil, and oleic acid are given, by means of which uniform and non-uniform mixtures were traced. Free oleic acid decreases the stability of the emulsion, and may even prevent it altogether. A number of terms have been defined which simplify investigation of soluble oils and make for greater convenience in comparing them. It is shown that the kind and quantity of mineral oil have practically no effect on the quantity of oleic acid that the mixture will tolerate and still give a good emulsion. This factor, on the other hand, varies with the kind of emulsifier, and even with the same type of emulsifier provided it is subject to adjustments. It is further shown that alcohol has the following effects: (*a*) acts as a liquefier for the soap; (*b*) at first decreases and then, as more alcohol is added, increases the quantity of free oleic acid required for a homogeneous product; and (*c*) exerts no direct effect on the emulsion. The addition of alkali to a soluble oil containing acid-sulphonated oil as the emulsifier yields the following results; (*a*) in the absence of alcohol, it at first decreases and then increases the quantity of free oleic acid required for a homogeneous product; (*b*) in the presence of sufficient alcohol, the more alkali the less oleic acid required to clear; and (*c*) the more neutralised the sulphonated oil the better it functions as emulsifier, the completely neutralised oil being the best in this respect. Procedures are developed for treating the raw materials used in soluble oils. These tests may also be employed for examining kindred products. Finally, methods are outlined for testing the stability of soluble oils, which may also be of service in stabilising such oils during manufacture.

FISHER (H. J.) & BAILEY (E. M.). **The Composition of some commercial Insecticides, Fungicides, Bactericides, Rodenticides and Weed Killers. A Compilation.** —*Bull. Connecticut Agric. Expt. Sta.*, no. 300, pp. 205–368. New Haven, Conn., January 1929.

This compilation has been made from regular or special bulletins of experiment stations or other departments in the United States and Canada. In the case of insecticides that are definite compounds only recent analyses are given, but for proprietary substances of which the composition is not evident all analyses found are included. Only one analysis is given unless different analyses show widely different

composition. The products are arranged in alphabetical order. Reference is made after each analysis to the source from which it was obtained.

Annual Letter of Information, no. 41.—*U.S. Dept. Agric., P.Q.C.A.*, S.R.A. no. 97 (Suppl.), pp. 157–234. Washington, D.C., November 1929.

This is a list of pests intercepted in the United States on imported plants and plant products from 1st January to 31st December 1928.

Ferris (G. F.). **The Effectiveness of a Plant Quarantine.**—*Science*, lxxi, no. 1829, pp. 68–69, 1 ref. New York, N.Y., 17th January 1930.

As an example of the apparent ineffectiveness of plant quarantines [*cf. R.A.E.*, A, xviii, 79], the author states that *Pseudococcus brevipes*, Ckll., has often been taken alive by him on bananas and pineapples in markets in California, in spite of the quarantine barriers. The fact that this Coccid and probably other insects have not become pests, he considers to be due, not to quarantines, but to biological factors.

Wadley (F. M.). **Observations on the Injury caused by** *Toxoptera graminum* **Rond. (Homoptera: Aphididae).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 7, pp. 130–134, 7 refs. Washington, D.C., October 1929.

In view of the peculiar effect of its feeding, *Toxoptera graminum*, Rond., is much more injurious than other grain Aphids. In experiments in Minnesota, plants infested by *Rhopalosiphum prunifoliae*, Fitch, or *Macrosiphum granarium*, Kby., supported colonies of Aphids for long periods, whereas they were quickly killed by similar numbers of *Toxoptera*. The injury to oats takes the form of pale or yellowish spots, which become confluent if numerous. A reddish spot is usually formed in the centre of the feeding puncture. All graminaceous plants on which *T. graminum* could be induced to feed for any length of time were injured in a similar manner. They included wheat, rye, barley, maize, *Sorghum* and a number of grasses. Where an entire leaf or large portion of it became pale, it shrivelled and dried after a day or two. No recovery was observed. Investigations to determine the effect of injury on the chlorophyll of the plants are described. Observations appear to indicate that the injury, which is caused by all forms and stages, is due to the injection of some substance, such as an enzyme, during the process of feeding and is not the result of the transmission of a virus. The spots did not spread after feeding had ceased.

Busck (A.). **A new Aegeriid on Cowpea from Brazil (Lepidoptera: Aegeriidae).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 7, pp. 134–136, 1 pl. Washington, D.C., October 1929.

Aegerina vignae, sp. n., is described from Bahia, Brazil, where it infests the stems of cowpeas (*Vigna sinensis*) and other cultivated leguminous plants.

McAtee (W. L.). **Paper Wasps** (*Polistes*) **as Pests in Bird Houses.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 7, p. 136. Washington, D.C., October 1929.

Brief notes are given on wasps of the genus *Polistes* making nests in bird boxes in an experimental chestnut orchard in Maryland.

Stearns (L. A.). **The Larval Parasites of the Oriental Peach Moth** (*Laspeyresia molesta* **Busck) with special Reference to the Biology of** *Macrocentrus ancylivora* **Rohwer.**—*Bull. New Jersey Agric. Expt. Sta.*, no. 460, 24 pp., 4 figs., 9 refs. New Brunswick, N.J., July 1928.

A list is given of the 42 primary and 5 secondary parasites of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental peach moth) recorded in the United States and Ontario, showing their distribution on this host. Of the primary parasites, *Macrocentrus ancylivora*, Rohw., *Glypta rufiscutellaris*, Cress., *Ascogaster carpocapsae*, Vier., *Eubadizon* sp., and *Lixophaga variabilis*, Coq., are generally distributed in the United States, but only the first two are of importance at the present time, *Macrocentrus* alone being sufficiently abundant to serve as a decided check on the host. In New Jersey it is also a parasite of *Ancylis comptana*, Froehl. (strawberry leafroller) [*R.A.E.*, A, xiv, 474], but parasitism of this host has only been recorded near Riverton.

In the insectary, adults of *M. ancylivora* lived on an average 11·4 days; they attacked the larvae of the host in all stages, but could not be induced to oviposit in the eggs or in pupae removed from their cocoons. Unfertilised females were as prolific as fertilised ones, but only produced diminutive males. Of the larvae produced by unfertilised females, only 3·2 per cent. survived the winter, as compared with 10 per cent. of the normal larvae. The larvae of *C. molesta* are usually only exposed to parasitism during three brief periods, namely, between hatching and initial entry into the twigs or fruit, when changing their feeding quarters, and when they finally emerge to spin their cocoons. It is probable, however, that the larvae in their burrows are also occasionally attacked. The incubation period of the eggs of *Macrocentrus* averages 3–4 days. The larva feeds for 10–12 days, and then emerges from the host and spins its cocoon within the partly constructed cocoon of the latter, the adult appearing 10–22 days later. The rate of development of the parasite is directly correlated with that of the host. In *C. molesta* its life-cycle averaged 28 days and in *A. comptana* 39·5, being in each case 7 days longer than that of the moths.

In New Jersey *C. molesta* usually has four generations a year, with sometimes a partial fifth. The larvae of each generation are attacked, parasitism being highest in the second and third generations, and only averaging 1 per cent. in the overwintering larvae. The average percentages of parasitism in 1925 and 1926 in six different localities in New Jersey were 30·15 and 31·0 respectively, as compared with 5·25 and 10·4 by *Glypta rufiscutellaris*. Distribution records indicate that *Macrocentrus* is most effective at lower altitudes and with a higher mean summer temperature and *Glypta* under the reverse of these conditions.

Vickery (R. A.). **Studies on the Fall Army Worm in the Gulf Coast District of Texas.**—*Tech. Bull. U.S. Dept. Agric.*, no. 138, 64 pp., 4 refs. Washington, D.C., October 1929.

A detailed account is given of the biology of *Laphygma frugiperda*, S. & A. (fall army worm) in the Gulf coast district of Texas, the greater part of the paper being devoted to its parasites [*cf. R.A.E.*, A, xvi, 452].

The following is taken from the author's summary: The moths migrate from the fields where they emerge, probably in search of suitable food-plants for oviposition. Although this habit enables the insect to escape the cumulative effect of parasitism, to which a species passing through many generations in a year might be subject, large numbers of moths reach localities where their progeny cannot survive the winter. Each female lays on an average 1,000 eggs, on or near the food-plant, in masses of two to four layers; as many as 400 eggs are found in a mass. The larvae begin to disperse during the latter part of the first instar. Maize and *Sorghum* are preferred food-plants, but other graminaceous and leguminous plants are also attacked, lucerne being sometimes severely damaged. There are 9–11 generations a year, all stages being present during the winter. In view of its tropical origin this Noctuid is unable to pass the winter in an inactive stage. It is attacked by a number of parasites, nearly all of which attack various hosts and have several generations a year. They may be of considerable importance locally in protecting crops of maize, destroying 40–50 per cent. of the larvae in the early instars during April–June.

Weiss (H. B.). **Results of the Ninth Year's Work against the Gipsy Moth in New Jersey.**—*Circ. New Jersey Dept. Agric.*, no. 169, 9 pp., 1 map. Trenton, N.J., September 1929.

This report follows the lines of the preceding one [*R.A.E.*, A, xvii, 166]. Only one colony of the gipsy moth [*Porthetria dispar*, L.] was found during 1928–29. As a result of the year's work, the area on which intensive work is to be carried out is reduced to 137 sq. miles.

Edwards (W. H.). **Some Tomato Pests in Jamaica.**—*J. Jamaica Agric. Soc.*, xxxiii, no. 11, pp. 405–407. Kingston, November 1929.

Heliothis (*Chloridea*) *obsoleta*, F., is injurious to tomatos in the drier parts of Jamaica. Several generations occur in a year, the most destructive being those hatching after the summer rains. The larvae bore into green or ripe fruits, frequently attacking one after another. Tomatos grown near maize fields or pastures are particularly liable to attack. Lands to be planted with tomatos should be well ploughed, harrowed and kept free from weeds for 2 or 3 months before planting, and all grasses should be kept down while the plants are growing. If there are no graminaceous plants available, the moths oviposit on tomato leaves, on which the young larvae feed for a few days before attacking the fruits. Paris green or lead arsenate dusted or sprayed every 10 days over the tomato plants at this time will destroy these and other Lepidopterous larvae, but must be discontinued as soon as the fruits begin to colour. Maize can be grown as a trap crop between the rows of tomato, but must be removed as soon as it is infested.

Protoparce sexta jamaicensis, Kby. (tomato hornworm) devours the foliage of tomato, tobacco and other solanaceous plants, but can be controlled by spraying. In gardens the larvae should be collected by hand, and as in certain parts of the Island they are heavily parasitised by Tachinids and Braconids, they should be kept in cages that admit of the escape of the parasites.

Report of the Division of Entomology.—*Ann. Rep. Porto Rico Insular Expt. Sta. Río Piedras*, pp. 89–98. San Juan, P.R., 1929.

Insects recorded as attacking the roots of sugar-cane in Porto Rico include a hitherto unreported Pyralid and the Fulgorid, *Oliarus cinereus*, Wolcott. In experiments, mosaic disease was also not transmitted by *Sipha flava*, Forbes, even when it was forced experimentally to feed on the tender leaves of the cane ; in nature this Aphid only occurs on the mature leaves. *Anastrepha fraterculus*, Wied. (West Indian fruit-fly) does not attack *Citrus* in Porto Rico, though it breeds freely in some varieties of guava and mango. *Cosmopolites sordidus*, Germ. (banana root weevil) continues to spread. It is suggested that seed of all banana varieties should be obtained and propagated at the Experiment Station so that suckers certified as uninfested could be distributed for planting. *Ipobracon grenadensis*, Ashm., introduced from Venezuela against *Diatraea saccharalis*, F. (sugar-cane stalk borer) has apparently failed to become established at Aguirre ; adults could not be found even on imported *Cordia*.

Stahl (C. F.) & Scaramuzza (L. C.). **Soil Insects attacking Sugar Cane in Cuba.**—*Bull. Trop. Plant Res. Found.*, no. 10, 19 pp., 18 figs. Washington, D.C., 1929.

With the exception of *Diatraea saccharalis*, F. (moth stalk-borer), the chief pests of sugar-cane in Cuba are soil insects that attack the underground parts of the plant. The most important of these is *Ripersia radicicola*, Morr. [*R.A.E.*, A, xv, 446]. Another Coccid, *Trionymus* (*Pseudococcus*) *sacchari*, Ckll., also feeds underground under certain conditions, being particularly injurious in seed-beds on account of its habit of clustering round the bases of the young shoots beneath the surface of the soil. This mealybug has never been found on the roots. It is usually attended by *Solenopsis geminata*, F., but another ant, *Tapinoma melanocephalum*, F., may also be found in association with it. Ants may be responsible for a certain amount of local dissemination, but the most important method of distribution is by means of infested seed pieces. These may be cleaned by dipping them in a solution of 40 per cent. nicotine sulphate, 1 : 800, with 2 lb. soap to each 500 U.S. gals. Soaking them in cold water for 72 hours gave complete control in the propagation plots at the experiment station. Ant control by means of a poison bait [viii, 285] is recommended as a supplementary measure. In order to protect the bait from dirt and rain the opposite sides of the tin container were bent inwards and the can nailed to a stake covered with a square piece of board.

Reports of injury by Elaterid larvae have been received from many widely separated localities throughout the Island. Soils that are well drained and somewhat sandy seem to be preferred. The length of the life-cycle has not been determined, but it is known that in one

species at least it occupies more than a year. The larvae feed on the roots, as many as 6–8 being found on one plant. Usually this type of injury occurs where the plants are not making normal growth, owing to unfavourable soil, but in some cases the wireworms are sufficiently numerous to cause injury even under favourable conditions. Seed pieces planted in fields infested with comparatively well-developed wireworms may be killed, the young roots being eaten and the germinating buds destroyed. One of the species found in the propagation plots was identified as *Monocrepidius bifoveatus*, P. de B. Predacious species of the genus *Pyrophorus* were always found in association with the injurious wireworms wherever infestations were investigated, and there is no doubt that they are of considerable value. Under favourable conditions, plants with the root systems already developed may be substituted for plants that have been destroyed. It is not advisable to prepare and plant immediately fields that have previously been abandoned and become covered with weeds, as they are usually infested. In small fields used for seed production, baits may be employed. In the propagation plots, small pieces of potato buried in the hills near the plants were dug up at regular intervals and the wireworms destroyed. There was practically no loss after the baits had been distributed, and 9,409 wireworms were collected from 25th July to 28th September 1928, 31 being larvae of *Pyrophorus*.

Although Lamellicorn larvae do not appear to be of special importance at present, the possibility of serious injury by these insects under certain conditions is great. The most conspicuous of these larvae found at the roots of sugar-cane in Cuba are those of *Strategus* spp. *S. titanus*, F., *S. anachoreta*, Burm., and *S. sarpedon*, Burm., have all been reported as feeding on this plant, but the last two species normally feed on decaying organic matter and are usually found about the base of decaying stumps. There is no evidence that they cause any great amount of damage. Injury by larvae of *Lachnosterna* (*Phyllophaga*) spp. has often been reported. A list is given of the species that have been collected, but no breeding work has been done to determine which are injurious. It is probable that *L. crenaticollis*, Blanch., which has been collected in numbers in spring and early summer is one of the injurious species and possibly the most important one. *Dyscinetus picipes*, Burm., has also been mentioned as a cane pest [*R.A.E.*, A, xii, 134].

Payne (N. M.). **Absolute Humidity as a Factor in Insect Cold Hardiness with a Note on the Effect of Nutrition on Cold Hardiness.**—*Ann. Ent. Soc. Amer.*, xxii, no. 4, pp. 601–620, 9 figs., 7 refs. Columbus, Ohio, December 1929.

Following recent studies in cold hardiness in insects [*R.A.E.*, A, xvii, 40], the author discusses in this paper the factor of absolute humidity and its influence on cold hardiness in *Popillia japonica*, Newm. (Japanese beetle) and *Hemerocampa leucostigma*, Smith & Abbott (white marked tussock moth) under Philadelphia conditions.

The paper is summarised as follows: Cold hardiness in the eggs and larvae of *H. leucostigma* bears a linear relationship to absolute humidity. Eggs are slightly more cold hardy than the 1st instar larvae; the 1st instar larvae are more cold hardy than the 2nd, and the 2nd more than the 3rd. Cold hardy eggs tend to produce cold hardy larvae. Cold hardiness of the Japanese beetle in relation to absolute humidity,

relative humidity and environmental temperature has been determined for all three instars of the larvae and the adults of *P. japonica*.

Nutrition influenced the cold hardiness of Japanese beetles kept at the same temperature and relative humidity. Starvation of 3rd instar larvae for two weeks increased their cold hardiness ; starvation for one month decreased it.

Plank (H. K.) **Natural Enemies of the Sugar Cane Moth Stalkborer in Cuba.**—*Ann. Ent. Soc. Amer.*, xxii, no. 4, pp. 621–640, 7 figs., 16 refs. Columbus, Ohio, December 1929.

During observations begun in Cuba in 1925, four major parasites of *Diatraea saccharalis*, F. (sugar-cane moth stalk-borer) were found, which collectively parasitised about half the borers in some localities at certain seasons of the year. The Tachinid, *Lixophaga diatraeae*, Towns., is the most important, is well distributed throughout the Island, and has been reared from borer larvae in every month of the year and from pupae in January, April, June and July. The percentage of parasitism is variable throughout the year and from year to year, sometimes reaching as high as 40. Oviposition has not been observed. This species has seldom been reared from larvae less than one-third to one-half grown when collected, and emergence practically always occurs from full-grown larvae, sometimes being delayed until after pupation of the host. Generally only one parasite emerges from each larva, and after emergence the maggot seeks a dry place for pupation. The puparium is usually formed at or near the opening of the borer tunnel, but is sometimes placed between the loose dry outer leaves of the cane. The length of the larval stage of the parasite is not known ; emergence has occurred as late as 25 days after collection of the borer larvae, but the average time was about 8 days. The pupal stage averaged about 10 days in May–July ; in cool weather or in artificially cooled containers this period may be doubled without apparent injury to the emerging fly, so that its shipment from one country to another could be arranged. A species of *Megaselia* (*Aphiochaeta*) was observed to be predacious on larvae of *L. diatraeae*. Parasitism by the latter was at its highest during or after periods of rainfall. After mid-August the number of borers generally increases with the age of the cane, and the percentage of parasitism seems to follow the periods of greatest abundance of borers that are one-third to one-half grown. The size of the stalk, and hence the availability of the borer for parasitism, also has some influence on the seasonal abundance of the parasite. The most important artificial condition that limits its numbers is the burning of cane trash either before or after harvest, and also the removal of dead hearts as a remedial measure against the borer, if these are destroyed without allowing the parasites to escape.

Apanteles diatraeae, Mues., is the parasite next to *L. diatraeae* in abundance and importance, being most active in late summer, autumn and winter. During this time up to 4 per cent. of the borers collected were parasitised, but the average is much less. As many as 40 larvae have been reared from one borer. The larvae, after leaving the host, congregate in a group and select a spot for pupation, generally near the mouth of a borer tunnel, the cocoons being stuck together in a mass. The maximum interval noticed between collection of the host larvae and emergence of the parasite was 47 days, and the pupal stage varies from 10 to 12 days. Rather low temperatures appear to

affect the activity of this species more than rainfall does. The burning of cane trash considerably delays its appearance.

Bassus (*Microdus*) *stigmaterus*, Cress., of which *M. diatraeae*, Turner [*R.A.E.*, A, vi, 333] and *M. crossi*, Brèthes [xvi, 159] are considered by Cushman to be synonyms, is rare, though occasionally present in some abundance during the summer. It is a parasite of the larva of *Diatraea*, though it has occasionally been reared from the pupa. Emergence was always obtained from larvae that were nearly full-grown, and in 18 days after collection. The importance of this Braconid is that it is present when all the other important parasites are least abundant, and at a critical period in the development of the host, when the cane is growing rapidly and the borer population is almost stationary.

Trichogramma minutum, Riley, which parasitises the eggs of *D. saccharalis*, has only recently been found. An average of 31·7 per cent. of egg masses collected yielded the parasite, though one mass had only one egg parasitised. Egg masses collected in March and April showed a higher percentage of parasitism that those collected later ; from July onwards no parasites could be obtained.

Minor parasites obtained were *Sarcophaga sternodontis*, Towns., *S. helicis*, Towns., *S. surrubea*, Wulp, *S. pedata*, Aldr., and *Chaetopsis fulvifrons*, Macq.

Spencer (H.) & Stracener (C. L.). **Soil Animals injurious to Sugar-cane Roots.**—*Ann. Ent. Soc. Amer.*, xxii, no. 4, pp. 641–648, 1 pl., 18 refs. Columbus, Ohio, December 1929.

The following is taken from the authors' summary : Root injury to sugar-cane by soil animals is prevalent in Louisiana, and extensive examinations of roots and adjacent soil have disclosed a distinct group of animals concerned. Experiments with the latter in hydrometer jars and pails containing growing cane have demonstrated that the root injury known as " pitting " is due principally to the feeding activities of the Collembola, *Lepidocyrtus violentus*, Fols., *Onychiurus armatus*, Tull., and to a less extent of *Proisotoma minuta*, Tull., and possibly *Neanura muscorum*, Fols. Extensive " pitting " has been produced experimentally also by the Symphylid, *Symphylella* sp., but the spring-tail, *Orchesella ainsliei*, Fols., and other members of the soil animal group did not pit the roots. A type of root injury, apparently more serious to the plants than pitting, was observed, especially in experimental pails containing *L. violentus* ; it consists of the almost total destruction of the secondary branch roots by the feeding activities of this springtail. In one test, with numbers of pails sufficient to give dependable averages, sprout growth was reduced 14 per cent. in the first 8–10 weeks in pails containing *L. violentus*, as compared with similar pails in which there were no springtails. An abundance of humus in greenhouse experiments with the springtails in pails did not prevent injury to sugar-cane roots.

Report on the Symposium on Termite Problems of the Termite Investigations Committee, September 2-13, 1929.—42 pp. San Francisco [Cal.], 1929.

This report include the following papers : California to the Fore in Termite Control, and Proper Construction as a Form of Insurance

against Damage by Termites [*cf. R.A.E.*, A, xviii, 114, etc.], by T. E. Snyder ; Termite Problems in California, and The Social Life of Termites, by A. E. Emerson ; and Why is there a Termite Problem in California ? by C. A. Kofoid.

Geiser (S. W.). **A simple Trap for the Capture of terrestrial Isopods.**—*Amer. Midl. Nat.*, xi, no. 5, reprint 2 pp. Notre Dame, Ind., September 1928.

An effective trap used by the author in collecting Isopods from soil consists of a potato or carrot, bored completely through lengthwise with a large cork-borer. A short section of the plug removed is cut off and used as a stopper at one end, the other end being left open. These traps should be laid in piles of rubbish where woodlice are abundant and should be lightly covered with litter ; if necessary, they may be baited with bacon. When the trap has been in place for some time, it is held vertically, sharply tapped, and the contents shaken into a dish. By this means, many usually rare species have been obtained, and one trap may yield as many as 300 adults of *Armadillidium* or *Porcellio laevis*, Latr., or numbers of *Metoponorthus*.

Fenton (F. A.) & Dunnam (E. W.). **Biology of the Cotton Boll Weevil at Florence, S.C.**—*Tech. Bull. U.S. Dept. Agric.*, no. 112, 75 pp., 36 figs. Washington, D.C., September 1929.

This bulletin gives the results of a detailed study of the bionomics of *Anthonomus grandis*, Boh. (cotton boll weevil) in South Carolina. Climate exerts an important influence on the seasonal cycle. Temperatures of 11° F. and lower are unfavourable to overwintering weevils ; hot, dry summers (as in 1925 and 1926) are also unfavourable. Squares punctured once remained on the plant for an average of about a week. Those more than 6 days old were always preferred for oviposition, but for feeding the younger the boll the more frequently it was punctured. Four generations occurred in a season, the first and second being large and the third and fourth incomplete ; the maximum emergence and oviposition of the different generations took place before the middle of August. Development of the weevil was most rapid during the period of maximum production of squares and was less after the plants had shed most of the squares and young bolls. The longevity and pre-oviposition periods of weevils in cages under varying conditions is discussed. Trap-crop records indicate that flight dispersal began about mid-July in 1925 and 1926. Temperature influences flight to some extent even after it has begun, more weevils flying at high temperatures. Dispersal was also correlated with the percentage of infestation.

The average winter survival during four years' observation was 3·27 per cent. The best protection was given by piled cotton stalks, other shelters in the order of their importance being maize stalks, pine litter, Spanish moss, sawdust or shavings and oat straw. There was a definite relation between rate of emergence from hibernation and type of shelter ; weevils in pine litter, maize stalks and Spanish moss continued to emerge later than those in other shelters. Migration to cotton after emergence occurred from mid-May to late June in 1925. Weevils emerging before cotton came up in 1925 and 1926 sometimes remained active in cages for several days or again entered hibernation.

A few weevils began to hibernate in early September and most of them did so in late September and October.

Parasites reared from infested squares were *Microbracon mellitor*, Say, which was by far the most numerous and important, *Catolaccus hunteri*, Crwfd., *Eurytoma tylodermatis*, Ashm., *Eupelmus cyaniceps* var. *amicus*, Gir., *Triaspis curculionis*, Fitch, and *Zatropis incertus*, Ashm. Adult females of *M. mellitor* lived for an average of 13 days, flying about infested cotton fields and piercing the outer layer of cotton squares and even the bolls to paralyse the weevil grubs within. Only squares on the plants are attacked, and mature or almost mature larvae are preferred for oviposition. A larva once paralysed does not recover, even though the parasite egg is removed before it hatches. The parasite larva is very active and crawls about the body of the host. When mature it spins a cocoon for pupation. In July and August the life-cycle from oviposition to emergence requires an average of 10 days. Only one parasite develops from a single weevil larva. The mortality of immature stages of *A. grandis* caused by parasites was 29·56 per cent. in hanging squares and 6·75 in fallen squares in 1925 and 22·7 and 7·84 in 1926, but the greatest mortality in fallen squares was caused by heat (41 and 26 per cent.).

Burgess (A. F.) & Crossman (S. S.). **Imported Insect Enemies of the Gipsy Moth and the Brown-tail Moth.**—*Tech. Bull. U.S. Dept. Agric.*, no. 86, 147 pp., 6 pls., 55 figs., 26 refs. Washington, D.C., August 1929.

An account is given of the life-history and habits of *Porthetria dispar*, L. (gipsy moth) and *Nygmia phaeorrhoea*, Don. (brown-tail moth), of their introduction and extension in the United States, and of the work of rearing and establishing foreign parasites and predators to control them. A total of 49 species have been introduced, of which 15 have become established ; the status of these in America is briefly reviewed. Their use has resulted in saving the forests of New England during the years 1920 to 1924. The combined percentage of parasitism by all species reached its maximum in 1923, but after 1924 *P. dispar* increased rapidly in eastern Massachusetts and defoliation is as severe as ever in a large part of the older infested area. The parasites were very much reduced in numbers in 1925, with an improvement in some species in 1926 and 1927, but it is impossible to predict conditions during the next few years, and unless the parasites increase rapidly, the chance of preventing the westward spread of the gipsy moth will be slight. In cities and towns artificial means of control can be practised, but in the large forest areas chief reliance must be placed on natural control by parasites and the elimination of the favourite food-plants by thinning. *N. phaeorrhoea* is now only destructive in the eastern part of the infested territory and has been more susceptible to the attacks of parasites. The work of the last 24 years has proved the great value of parasite introduction.

Todd (F. E.). **The Olive Fly** (*Dacus oleae* **Rossi**).—*Mon. Bull. Calif. Dept. Agric.*, xviii, no. 10, pp. 527–533, 4 figs., 15 refs. Sacramento, Cal., October 1929.

An account is given of *Dacus oleae*, Gmel., in Spain, chiefly taken from the literature, and the disastrous results that would occur if it

were introduced into California are pointed out. Adults of this Trypetid were intercepted in the United States in olives from South Africa in 1915, adults and larvae in fresh olives from Italy in 1923 and 1924, and pupae in straw packing for melons in 1923.

Ryan (H. J.). **New Weevil makes its Appearance in California.**—*Mon. Bull. Calif. Dept. Agric.*, xviii, no. 10, p. 567. Sacramento, Cal., October 1929.

Otiorrhynchus (*Brachyrrhinus*) *cribricollis*, Gyll., a European weevil not hitherto known in North America, has recently been discovered in California. As the adults do not fly and specimens have been received from localities covering a wide area, the weevil is thought to have been present for several seasons. The larvae feed on the finer roots of a number of plants, including deciduous fruits and *Citrus*, and the adults attack the foliage and fruit and leaf buds. Observations hitherto carried out indicate that privet is the preferred food-plant in California. The adults are night feeders and hide under the leaves and in ground cracks during the day.

Brock (A. A.). **Oil Spray Damage to Citrus.**—*Mon. Bull. Calif. Dept. Agric.*, xviii, no. 10, pp. 572–573. Sacramento, Cal., October 1929.

The use of sprays on *Citrus* has greatly increased in Orange County, California, during the past 5 years, and is now as general as fumigation. The highly refined white oils most extensively employed, however, when not sufficiently refined, or when containing toxic materials, often cause severe dropping of the fruit or foliage, and may retard the colouring of the fruit. Oils mixed with lime-sulphur and used during the late summer, or before periods of hot wind, produce very severe scorching. Applications in late autumn cause a drop of green fruit and prevent the proper development of that remaining on the trees ; and a general decrease in the growth of oranges sprayed in autumn has been demonstrated by measurements. The texture and quality of the fruit is also impaired to a varying extent by applications at certain seasons. Reduction of the amount of blossom caused by spraying with oil in autumn has been repeatedly observed, and on this account, combined with the effect on the quality of the fruit, the use of heavy oils on oranges has been discontinued. In the case of lemons a thorough picking is made just before treatment, and picking subsequent to treatment is delayed as long as possible to allow the fruit to recover from the effects of the oil. Most of the materials in use in 1928 caused foliage or fruit drop when applied to trees needing irrigation. Even highly refined oils, if absorbed by the trees, leaves and branches, eventually become toxic to them, and it is difficult to find an oil heavy enough to obtain a satisfactory kill and yet light enough to disappear from the trees, on the supposition that the disappearance of the oil would involve less killing of the inside wood.

Brock (A. A.). **Control of Moths attacking Lawns.**—*Mon. Bull. Calif. Dept. Agric.*, xviii, no. 10, p. 574. Sacramento, Cal., October 1929.

Lepidopterous larvae found injuring the roots of blue grass, bent grass and clover in lawns in California have been identified as *Crambus*

cypridalis, Hulst, and *C. bonifatellus*, Hulst. The presence of a large number of parasites indicates that the injury may be due to a mere seasonal increase of the moths. A control measure suggested is the application of lead arsenate to the soil. In preparing new lawns, 1 lb. acid lead arsenate should be broadcast on the surface of each 30 sq. ft. of ground to be treated before the seed is sown ; the treatment should be effective for several years. When applied as a top dressing to turf already injured by the larvae, the lead arsenate should be mixed with 15 times its weight of good top soil and this mixture applied at the rate of 7½ lb. to 100 sq. ft. of surface.

STEARNS (L. A.) & PETERSON (A.). **The Seasonal Life History of the Oriental Fruit Moth in New Jersey during 1924, 1925 and 1926. A summarized Report.**—*Bull. New Jersey Agric. Expt. Sta.*, no. 455, 48 pp., 10 figs. New Brunswick, N.J., December 1928.

An account is given of the seasonal life-history of *Cydia* (*Laspeyresia*) *molesta*, Busck, as studied during 1924–26 in New Jersey, where there are normally four generations a year, with an additional generation in the southern two-thirds of the State if the season begins early [*cf. R.A.E.*, A, xv, 302 ; xvi, 133]. The detailed records show that there is a definite correlation between the seasonal history of the insect and the development of foliage, flowers and fruit on the trees, from the transformation of overwintered larvae, at about the time the peach buds begin to swell, to the maximum deposition and hatching of the 4th generation eggs, which either coincides with or immediately precedes the harvest of late varieties.

HEADLEE (T. J.) & GINSBURG (J. M.). **Studies of combined Sprays for destroying the overwintering Eggs of the European Red Mite and Apple Aphids at the delayed dormant Period of the Apple Tree.**—*Bull. New Jersey Agric. Expt. Sta.*, no. 469, 15 pp., 4 refs. New Brunswick, N.J., April 1929.

The experiments against the overwintering eggs of Aphids and *Paratetranychus pilosus*, C. & F., described in the first part of this paper, by Headlee, have been previously noticed [*R.A.E.*, A, xvi, 558]. In the second part, by Ginsburg, an account is given of experiments to determine the amount of nicotine evolved from mixed sprays during a definite period of time (72 hours), when two proprietary spray mixtures, both containing 40 per cent. nicotine, were used, one being an aqueous solution and the other nicotine sulphate. The technique employed and the reactions involved are discussed. It was found that more nicotine is evolved from the aqueous solution than from the nicotine sulphate when mixed with either lime-sulphur, 1 : 9, or with a 3 per cent. oil emulsion. The higher rate of nicotine volatilisation apparently increased the toxicity of the spray against the eggs of apple Aphids. More nicotine is evolved from nicotine sulphate when mixed with lime-sulphur than when mixed with oil emulsion. The combination of lime-sulphur and oil emulsion precluded rapid volatilisation of nicotine when either of the nicotine mixtures was used.

DRIGGERS (B. F.). **Lead Arsenate Studies on Cranberry Bogs in New Jersey.**—*Bull. New Jersey Agric. Expt. Sta.*, no. 480, 36 pp., 43 refs. New Brunswick, N.J., March 1929.

This is a more detailed account of experiments on the use of lead arsenate sprays in cranberry bogs, a summary of which has already been noticed [*R.A.E.*, A, xvi, 560]. Yields over a period of four years indicate that a cumulative injurious effect on cranberry vines results from the use of a combined spray of Bordeaux mixture and acid lead arsenate to which resin fish oil soap is added.

HYDE (A. M.). **Special Statement on Mediterranean Fruit Fly Campaign.**—5 pp. mimeograph. Washington, D.C., U.S. Dept. Agric., Office Inform. Press Service, 30th January 1930.

This is a general review of the history and importance of the outbreak of the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in Florida. The United States Department of Agriculture has spent more than £800,000 during 10 months in the work of eradication, which has been more successful than was hoped. No adult flies have been seen in Florida since 7th August 1929, and no infestation of any kind since 16th November 1929. This is no guarantee, however, that the fly has been eradicated, and the abandonment of the work would probably mean that the money already spent had been wasted.

BONDAR (G.). **Insectos damninhos e molestias da laranjeira no Brasil.** [Diseases and Insect Pests of Oranges in Brazil.]—*Bol. Lab. Path. veg.*, no. 7, 79 pp., 40 figs. Bahia, 1929.

Notes are given on the bionomics and control of a number of pests of oranges in Brazil, of which many have been recorded previously [*R.A.E.*, A, ii, 173; iv, 201]. Others include the Lamiid, *Leptostylus pleurostictus*, Bates; the Cerambycid, *Coleoxestia spinipennis*, Serv.; the Curculionid, *Cratosomus flavofasciatus*, Guér.; *Papilio anchisiades*, Esp., and *P. thoas*, L.; the Tortricid, *Gymnandrosoma aurantianum*, Costa Lima, previously erroneously recorded as *Tortrix citrana*, Fern. [iv, 201]; the leaf-cutting ant, *Atta sexdens*, L., which is the chief pest of *Citrus* in Brazil; a bee, *Melipona ruficrus*, Latr., which does much harm to the leaf and flower buds; fruit-flies, of which *Anastrepha fraterculus*, Wied., is the commonest, though *Ceratitis capitata*, Wied., has been recorded from various localities; *Parlatoria pergandei*, Comst., which, though little known, is an important pest; *Aleurothrixus floccosus*, Mask.; *Toxoptera aurantii*, Boy., which is common in the rainy areas; *Frankliniella insularis*, Frankl., which is the most injurious thrips; a Psocid, *Archipsochus brasilianus*, Enderl.; and the mites, *Phyllocoptes* (*Eriophyes*) *oleivorus*, Ashm., *Tenuipalpus bioculatus*, McG., *T. californicus*, Banks, and *Anychus* (*Tetranychus*) *banksi*, McG.

MONTE (O.). **Uma nova praga do feijão,** *Cerotoma uncicornis*, **Germ.** [A new Pest of French Beans.]—*Chacaras e Quintaes*, xl, no. 6, p. 587, 1 fig. S. Paulo, 15th December 1929.

The Galerucid, *Cerotoma uncicornis*, Germ., is recorded as feeding on the leaves of French beans in the State of Minas Geraes, Brazil, causing the plants to wither and die. As neither eggs nor larvae were found

on the beans, this beetle probably breeds on some wild plant ; only leguminous plants were attacked in feeding experiments.

de Andrade (E. N.). **A mosca da madeira.** [The Timber Fly.]—*Chacaras e Quintaes*, xl, no. 6, pp. 595–597, 2 figs. S. Paulo, 15th December 1929.

Very little is known concerning the large timber-infesting fly, *Pantophthalmus pictus*, Wied., and this note is preliminary to a report on observations made by the author in Brazil. A list is given of trees found to be attacked by the larvae, which bore into the wood. Of over 7,000 trees of the genus *Casuarina* examined in S. Paulo, 40 per cent. were infested. The egg stage lasts 22–26 days, the total life-cycle requiring two years. In four consecutive years, the first adults emerged early in October and the last usually in March.

Wolcott (G. N.). **Informe del jefe de la sección de entomologia.** [Report of the Chief of the Entomological Section, Experiment Station of the National Agrarian Society, Lima, Peru.]—*Mem. Estac. exptl. agric. Soc. nac. agrar.*, 1927–1928, no. 1, pp. 31–62, 111–115, 12 figs. Lima, January 1929.

This report deals with pests of sugar-cane, cotton and *Citrus* observed in 1928, of which all the important ones have been recorded in other papers [*R.A.E.*, A, xvii, 99, 319, 657, 667, etc.].

Munro (J. W.) & Thomson (W. S.). **Report on Insect Infestation of Stored Cacao.**—*E.M.B.* 24, 40 pp., 4 pls., 46 refs. London, H.M. Stationery Office, December 1929. Price, 1*s.* 6*d.* net.

Previous literature on pests of stored cacao is reviewed, and an account is given of a survey made in London warehouses, including notes on the methods of storage and the infestation of consignments from various countries. The product is frequently found to be infested on arrival, the insects having probably attacked it during the drying stages in the country of origin. The most important of these pests are *Araecerus fasciculatus*, DeG., *Corcyra cephalonica*, Staint., and *Ephestia elutella*, Hb. The first of these is widely distributed in tropical countries, but has but little resistance to cold and soon becomes sluggish and dies during the cold weather in England, so that it is improbable that it can maintain itself without re-importation. It is an important primary pest of nutmegs, which are apparently the preferred food, and is at present a serious pest of cacao only in consignments from the Gold Coast. The damage to cacao beans is characteristic ; the bean shows a large exit-hole, while inside it the cotyledons are largely replaced by the larval frass, in the form of a yellowish dust, entirely different from that of *Ephestia*. The bean is often very much hollowed out by the larva (only one of which is found in each bean), and pupation generally occurs within it, which is again unlike *Ephestia*. It is possible that cacao may be sometimes infested from nutmegs stored in the same warehouse during the summer, but this could not occur in winter.

Corcyra cephalonica is comparatively widely distributed as a cacao pest, but the degree of infestation is almost negligible. In its life-history and the damage done it is very similar to *Ephestia*, but it is

not yet known whether it can withstand the winter in Britain. The cocoons constructed by the mature larvae are made of thick white silk, whereas those of *Ephestia* are smaller and greyish, and are often clustered or even matted together.

Ephestia elutella is by far the most important of these cacao pests, and is found in London warehouses on cacao from all parts of the world, no variety being immune. It also attacks many other kinds of food and stored products and is continually being introduced from one source or another abroad. Examination of infested bags of cacao showed that the maximum larval abundance occurred in July–August, followed by maximum pupal numbers in September. What takes place between December and April is not yet known. This species seems capable of withstanding intense cold, and larvae have been found in hibernation among sheets of paper in a warehouse during a severe London winter. From about the end of June to mid-August, and particularly in July, the adults occur abundantly, often in such numbers as to be a serious nuisance. The indications during examinations in 1928 were that cacao arriving at the warehouses between January or February and July was the most heavily infested. Both adults and larvae show a great aversion from light, and the larva, having once secreted itself in a crack in the husk of a cacao bean, remains there until mature. Biological experiments have shown that there is quite a definite inconstancy in the rate of development of individual larvae, so that some of the progeny of the July infestation may develop quickly and emerge in October, while the majority emerge in the following May, June or July and others may take longer still to complete the cycle. It is conceivable that larvae and pupae introduced in autumn and winter are retarded long enough to increase the numbers of the next July flight, while those introduced in spring and summer may comprise the greater number of the July moths and also the majority of those seen in May, June, late August and September.

E. elutella is sometimes heavily parasitised by *Microbracon hebetor*, Say, which attacks large rather than small larvae. When full-grown, the parasite larvae spin small, white cocoons near the shrivelled remains of their hosts. The adults are most numerous in September and early October, when the full-grown larvae of *Ephestia* have begun to wander. Many that have escaped parasitism are then stung, but oviposition does not apparently take place ; the host larvae die almost immediately, and their dead bodies may be seen in hundreds adhering to the cacao bags and to the ceiling. The life-cycle and habits of this parasite under conditions in Britain require working out, as well as the possibility of its use for the biological control of *E. elutella* in warehouses. The Bethylid, *Holepyris hawaiiensis*, Ashm., parasitises larvae of both *E. elutella* and *Corcyra cephalonica*, but is not at all numerous and cannot at present be considered of any importance.

Preliminary tests have been carried out to determine the effect on *E. elutella* of fumigation of cacao in bags with hydrocyanic acid gas. The result showed practically 100 per cent. mortality of larvae, pupae and adults, after 9 hours' exposure to a concentration of gas of about 1·5 per cent., and the cacao beans were found to absorb a relatively low amount of the gas ; in any case the roasting of the beans during manufacture would eliminate any gas absorbed. A proprietary spray killed all larvae that it touched but was ineffective as a deterrent. Strips of grease-proof paper smeared with adhesive and pasted in a continuous band around the walls were successful in trapping the

larvae, but required constant renewal. All remedies in England can be only palliatives, and control should begin in the country of export.

Some 30 species in all have been found in association with stored cacao, and during the survey of warehouses it was found that the weevil, *Caulophilus latinasus*, Say, and the Anobiid, *Lasioderma serricorne*, F., are major pests of ginger. Breeding in cacao beans and in dust and particles of various stored products were *Ptinus tectus*, Boield., and beetles of the genus *Laemophloeus*. Species of *Cryptophagus* were found associated with various moulds and may be attracted by the moulds produced in cacao. Other insects not connected with any particular product were Muscid, Tachinid and Drosophilid flies, and the beetles, *Lyctus brunneus*, Steph., and *Dinoderus minutus*, F.

Staniland (L. N.) & Walton (C. L.). **The Long Ashton Tar Distillate Wash: Field Experiments, 1929.—II.**—*J. Minist. Agric.*, xxxvi, no. 9, pp. 828–835, 3 pls., 1 diagr., 4 refs. London, December 1929.

An account is given of the concluding stages of field experiments with the Long Ashton tar-distillate wash against *Plesiocoris rugicollis*, Fall., on apples in England, the preliminary results of which have already been noticed [*R.A.E.*, A, xvii, 673]. Estimation of the damage by eye was disregarded, and the figures obtained are the result of actual counts and weighings of the crop from the trees. The fruit was graded into two classes: those apples showing definite Capsid injury, whether pronounced or slight only, and those entirely free. Detailed results are shown in tables. The amount of fruit marked by *P. rugicollis* was greatly reduced on trees sprayed with Long Ashton tar-distillate wash at 10 per cent. strength, when compared with unsprayed trees and with those sprayed with the proprietary wash at the same strength. Moreover, in several instances there was a noticeable increase in the weight of clean fruit as well as in the total weight of the crop. These results show that the statement made regarding the consistently high degree of control obtained against *P. rugicollis* on apples with Long Ashton tar-distillate wash at 10 per cent. strength [*loc. cit.*] is fully justified as a general rule, and the recommendations for spraying apples with this wash during the dormant season are repeated.

Grassé (P. P.). **Un ravageur des arbres fruitiers : la zeuzère.**—*Prog. agric. vitic.*, xcii, no. 49, pp. 544–547. Montpellier, 8th December 1929.

For some years the larvae of *Zeuzera pyrina*, L., have caused considerable damage to fruit trees in the south of France. The larva, pupa and adults of both sexes are briefly described. The moths are present from June to October, being most numerous from the middle of July to the middle of September. Eggs are laid singly or in batches of three or four in cracks in the bark of the trunks or branches and hatch in 10–15 days. The young larvae probably migrate for a short distance before boring into the bark, so that two or more are rarely found in the same branch. It is estimated that a single female lays from 150–200 eggs and lives for several weeks. At the end of one or two months the larva bores into the wood, working upwards for 11–16 ins. Its presence

is revealed by excreta ejected from the lower end of the burrow. The infested branches dry up and die. The length of the life-cycle varies with the climate; in Mediterranean regions it lasts about 10 months; in Languedoc about a year, and in the centre of France probably two years. In certain woods development is more rapid than in others. When mature, the larva descends the gallery and forms a cocoon near the opening. The pupal stage lasts two or three weeks. *Z. pyrina* has many food-plants, but in this region apples, pears and plums are most frequently attacked. Observations on an orchard near Montpellier, into which the moth was introduced with young quince trees, showed that spread was slow. Old trees were the first attacked and succumbed in a short time, and young trees given proper treatment survived, from which it appears that the larvae prefer wood without too great a flow of sap.

The most effective method of control consists in inserting 0·1–0·2 gm. calcium cyanide or 0·2–0·4 gm. paradichlorobenzene in the galleries and subsequently closing up the openings.

DOUENCE (A.). **Les tipules.**—*Rev. Zool. agric.*, xxviii, no. 8, pp. 113–123, 4 figs., 21 refs. Bordeaux, August 1929.

Lists are given of the more injurious species of Tipulids known to occur in Germany, Italy, England and Holland, and their morphology, bionomics and control are collectively discussed from the literature. The author has secured good results with baits consisting of 1 part copper arsenite to 25 parts sawdust or 17 parts bran, moistened with water. The baits may be scattered at random or in rows, as the larvae come to the surface during the night.

BETREM (J. G.). **De iepenziekte en de iepenspintkevers.** [The Elm Disease and the Elm Cambium Beetles.]—*Tijdschr. Plantenziekt.*, xxxv, no. 11, pp. 273–287, 3 pls., 55 refs.; *Versl. & Meded. Plantenz. Dienst*, no. 60, pp. 3–17, 3 pls., 55 refs. Wageningen, 1929 & 1930. (With Summaries in German.)

An account is given of experiments in Holland with *Scolytus scolytus*, F., to test the possibility of this beetle and the allied *S. multistriatus*, Marsh., being concerned in the spread of the fungus, *Graphium ulmi*, which is the cause of the Dutch elm disease. *S. scolytus* has two generations a year, the adults appearing at the end of May or early in June and again in August. Maturation feeding of the young adults occurs in the bark, cambium and buds of the highest branches of healthy as well as of diseased elms; and the females make mines for oviposition in the bark of diseased or weakened trees. Beetles taken from diseased trees were shaken up in water, and this water produced colonies of *G. ulmi* on agar culture plates. Beetles allowed to move on sterile agar plates gave rise to infections of *G. ulmi*, as did the intestines of beetles that had been externally disinfected with a strong solution of mercury bichloride. It is probable that the adult beetles acquire the infection in the pupal chamber and transmit it during maturation feeding. Beetles boring mines in weakened trees may also infect them. There is a connection between drought and elm disease, because lack of water in the tree enables the beetles to penetrate. Trees that have been transplanted should be well watered to protect them against the beetles. For control it is necessary to fell all infested trees, preferably

in late July or early August and during the winter. The bark must be removed and destroyed, as it harbours beetles and the fungus fructifies on its inner surface, and also on the outer surface if the bark is wet.

de Fremery (P.). **Over omnivore Insecten in Copra.** [Omnivorous Insects in Copra.]—*Ber. Afd. Handelsmus. kol. Inst.*, no. 44, 10 pp., 2 figs. Amsterdam, 1929. (Reprint from *De Indische Mercuur*, no. 20, 15th May 1929.)

A case of copra, opened at Amsterdam, was found to be infested by *Silvanus surinamensis*, L., *Tribolium castaneum*, Hbst., and *Necrobia rufipes*, DeG., over 95 per cent. of the insects being *S. surinamensis*. Examination of the material led to the conclusion that this beetle prefers copra of which the cell structure has broken down. Cell degeneration is probably the result of the occurrence of bacteria at the time the copra is dried, so that the preparation of the product is a factor of great importance as regards its susceptibility to attack by pests [*cf.* *R.A.E.*, A, xvii, 685].

6. **Konferenz betreffend die Bekämpfung von Krankheiten und Schädlingen der Obstbäume.** [Sixth Conference on the Control of Diseases and Pests of Fruit Trees.]—*Schweiz. Z. Obst- u. Weinbau*, xxxix, no. 1–2, pp. 1–69, 6 figs. Wädenswil, 18th January 1930.

The papers read at this meeting on 30th November 1929 at Wädenswil, Switzerland, included a statement by W. Peter that Dr. Wiesmann had found a spray of 8 per cent. fruit-tree carbolineum applied on 17th April when the fruit buds were slightly open and a few leaves were present to be a very good repellent for protecting apple trees against the apple blossom weevil [*Anthonomus pomorum*, L.]. The leaves were slightly scorched, but soon recovered; blossoming was delayed for about 8 days. Dr. M. Staehelin reported on work against the small winter moth [*Cheimatobia brumata*, L.], which is a very dangerous pest of cherries in Switzerland, where the large winter moth [*Hybernia defoliaria*, Cl.] is rare. When the moth is very abundant, two adhesive bands, one placed higher up than the other, have given such excellent results as to justify the double expense. W. Erni found that two sprayings with a mixture of lead arsenate and lime-sulphur (just before and after blossoming) followed by two sprayings with a mixture of lime-sulphur and hydrous ferrous sulphate proved very successful in protecting cherry trees against *C. brumata* and the shot-hole disease of cherry. H. Spreng reported that whereas 86·4 per cent. of the leaves of untreated trees had been damaged by the moth and the fungus, the injury was 37 per cent. when a spray of lime-sulphur and lead arsenate had been applied. Dr. R. Menzel found that the exceptionally severe winter of 1928–29 did not affect the winter moth. Early summer treatment with an arsenical and lime-sulphur is decidedly valuable, but a single application of fruit-tree carbolineum in winter does not give effective control. Corrugated cardboard bands for trapping the larvae of the codling moth [*Cydia pomonella*, L.] should be applied at the end of June and removed in October, unless examination of them shows that a second generation will occur, in which case they should be removed in July and replaced. Menzel also records the introduction in the autumn of 1928 into Wädenswil from Tyrol

of the Chalcid, *Aphelinus mali*, Hald., against the woolly aphis [*Eriosoma lanigerum*, Hausm.]. The parasite withstood the extremely cold winter, with such temperatures as −26° C. [−14·8° F.], the parasitised Aphids being sheltered in cracks in the bark, etc. Its establishment was evident through the following summer and autumn. Dr. K. Meier stated that two applications of calcium arsenate are more effective than one of lead arsenate against the codling moth and its use avoids the risk of dangerous residues on the apples. Experiments described by A. Zeller indicate that calcium arsenate would be equal to lead arsenate if its adhesive properties were as good.

COSTANTINO (G.). **La mosca delle frutta** (*Ceratitis capitata*) **Wiedemann).**—*Circ. R. Lab. Ent. agrar.*, no. 6, 14 pp., 7 figs. Portici, December 1929.

Brief descriptions are given of all stages of *Ceratitis capitata*, Wied., and of its distribution, with a list of the fruits infested by it in Italy. Up to now it has not been found in grapes grown in that country. *Citrus* is attacked severely only if the fruit is left on the trees after becoming sufficiently ripe for market. The life-history of the fly is described. In favourable circumstances it can have 6 or 7 generations a year in southern Italy and Sicily, of which the first, from January to March or April, and the seventh, in November and December, attack oranges. In peach-growing districts the third generation of the fly becomes harmful in the second half of July, which is the beginning of the normal ripening period of peaches, whereas the second generation (May—June), which infests the few oranges left on the trees or early peaches and apricots, is very scanty.

Attempts are to be made to introduce a Chalcid parasite, *Syntomosphyrum indicum*, Silv., from South India ; a previous importation, in 1909, did not succeed. A special trap for the flies consists of a glass jar about 4½ ins. high, 3½ ins. wide at the base and narrower at the neck, which has a screw cap of zinc, to which a hook is attached to hang the jar in the tree. The bottom of the jar rises inwards like a cone 1¾ in. high, at the top of which there is an aperture ⅜ in. in diameter by which the flies enter. The bait is water containing 20–25 per cent. of wine vinegar or 10 per cent. of beet molasses from which the sugar has been removed. The traps should be hung up about the end of May or early in June, at the beginning of the second generation ; one jar is effective for a radius of about 10 ft.

STROHMEYER (H.). **Zwei neue Borkenkäfer aus Spanien.** [Two new Bark-beetles from Spain.]—*Ent. Bl.*, xxv, no. 4, pp. 181–182, 1 pl. Berlin, 31st December 1929.

The new Scolytids described are *Ips* (*Pityogenes*) *herbellae*, from *Pinus sylvestris*, and *Crypturgus barbeyi*, from *Abies pinsapo*.

STROHMEYER (H.). **Forstentomologische Studien im** *Pinsapo*-**Wald der Sierra de Ronda.** [Entomological Studies in the Forest of *Abies pinsapo* in the Sierra de Ronda.]—*Z. PflKrankh.*, xl, no. 1–2, pp. 1–7, 8 figs. Stuttgart, [1929] 1930.

This study of the insect pests of *Abies pinsapo* in a 1,500-acre forest in the Sierra de Ronda, Andalusia, was carried out in 1927. The species

found were a small moth, which was the only pest of primary importance, the larvae injuring the buds and current year's leaves; *Buprestis flavoangula*, Fairm., previously known only from Algeria and Morocco, where it infests *Cedrus atlantica* and *Abies numidica*, mining the bark and cambium; *Cryphalus numidicus*, Eichh.; and *Crypturgus barbeyi*, Strohm. [see preceding paper], which is probably the species recorded as *Crypturgus numidicus*, Ferr., by Bezares in 1928 [*R.A.E.*, A, xvii, 574].

Frydrychewicz (J.). **Nonnenstudien.** [Nun Moth Studies.]—*Z. Pfl Krankh.*, xl, no. 1–2, pp. 26–44, 3 figs., 5 refs. Stuttgart, [1929] 1930.

To obtain data on the biology of *Lymantria monacha*, L., the author bred numerous larvae in batches of 5–6 in boxes, and noted such points as the weights of the larvae, of the needles eaten, of those cut off but not consumed, and of the excreta, and the number of excreta particles. A description is given of the technique employed, and the figures obtained for the various instars are shown in tables.

Streiter (—). *Tachycines* **Bekämpfung.** [Measures against *Tachycines.*]—*Die Gartenwelt*, 1928, p. 175. (Abstract in *Z. Pfl Krankh.*, xl, no. 1–2, p. 94. Stuttgart, [1929] 1930.)

The grasshopper, *Tachycines* [*asynamorus*, Adel.] and ants in greenhouses may be trapped in bottles one-third filled with rum diluted with water and sunk in the soil up to the neck.

Jancke (O.) **Beiträge zur Biologie und Bekämpfung der Kirschblütenmotte** (*Argyresthia ephippiella* **F.**). [Contributions to the Biology and Control of the Cherry Blossom Moth.]—*Die Gartenbauwiss.*, ii, p. 300, 3 figs., 1929. (Abstract in *Z. Pfl Krankh.*, xl, no. 1–2, pp. 97–98. Stuttgart, [1929] 1930.)

In further investigations at Naumburg, Germany, on *Argyresthia ephippiella*, F., on cherry [*cf. R.A.E.*, A, xv, 557], a flight-period lasting from mid-June to mid-September was observed [*cf.* xvi, 612]. Eggs begin to be laid in large numbers in the third week after emergence (early July), and oviposition reaches its maximum five weeks later. The Encyrtid egg-parasite, *Ageniaspis atricollis*, Dalm., became abundant only when the host eggs were present on the branches. Of the various insecticides tested, a reliable fruit-tree carbolineum is held to be the most convenient and economical.

Arthold (M.). **Die Engerlingbekämpfung.** [Measures against White Grubs.]—*Landwirtsch.*, 1928, pp. 62–63. Vienna, 1928.

Der Rebenwickler "Pflanzenschutz." [The "Pflanzenschutz" Vine Envelope.]—*T.c.*, pp. 157–158, 2 figs. (Abstracts in *Z. Pfl-Krankh.*, xl, no. 1–2, p. 101. Stuttgart, [1929] 1930.)

As a protection against Lamellicorn larvae in Austria, vines before planting are enclosed in a fine-meshed netting of wire, and then dipped in a thin paste of clay, which fills the cylinder of netting.

Escherich (K.). **Die Bekämpfung der Kiefernblattwespe** (*Lophyrus pini* **L.**) **im Schwetzinger Wald mit "Forstesturmit."** [Work against the Pine Sawfly in the Schwetzinger Forest with "Forstesturmit."]—*Forstwiss. Zbl.*, 1928, p. 885, 1 fig. (Abstract in *Z. PflKrankh.*, xl, no. 1–2, pp. 102–103. Stuttgart, [1929] 1930.)

In 1927, 1,500 acres of pines at Schwetzinger, Germany, were infested by *Diprion* (*Lophyrus*) *pini*, L. Treatment of the trees with proprietary arsenical dusts killed the larvae in large numbers.

[**Practical Information for Gardeners and Fruit Growers in Bavaria.**]—*Prakt. Bl. Pflanzenb.*, vii, no. 10–11, pp. 237–289. Freising, 1930.

This issue of this journal includes papers on the official Bavarian plant protection service, by Dr. Korff; the need for organisation in work against pests, by Trenkle; the present position regarding remedies against diseases and pests of plants, by Dr. Korff; insect pests of vegetables and their control, by Dr. K. Flachs; the use of calcium cyanide against greenhouse pests, by Weidinger; and diseases and pests in orchards and gardens in 1929, by Drs. Korff and Böning.

Catoni (G.). **Die Birngallmücke** (*Diplosis-Contarinia pyrivora* **Riley**), **einer der gefährlichsten Obstbaumschädlinge.** [The Pear Gall-midge, *C. pyrivora*, one of the most dangerous Fruit-tree Pests.]—*Anz. Schädlingsk.*, v, no. 12, pp. 149–155, 8 figs., 1 ref. Berlin, 15th December 1929.

An account is given of observations on *Contarinia pyrivora*, Riley, (pear gall midge) made in the Trentino, Italy. To obtain adults emerging from pupae in the soil, boards were placed on bricks laid on the ground, the spaces being walled up with earth. Lamp glasses, plugged at the upper ends, were placed over holes cut in the boards. Emergence occurs principally in the morning, and may be interrupted for several days by rain, cold, or wind. It takes place about the time that the pear-buds blossom, and oviposition begins immediately afterwards. A female lays 10–30 eggs, not always all in the same blossom. These hatch in 4 or 5 days. The larvae feed on the flower juices and then attack the ovary. As the infested fruits grow, they become gourd-shaped; each usually contains 15–20 larvae, but up to four times that number may occur when several flies have oviposited in one place. After completely devouring the inner parts of the young pear, the larvae drop to the ground and spin their cocoons at a depth of up to 2 inches. They aestivate as larvae and hibernate as pupae. The cocoons underground can resist the severest drought, but soon dry up when exposed to air and sunshine. Pears that blossom late or very early are less severely infested.

Parasites that are very effective in reducing the numbers of *C. pyrivora* include *Platygaster lineatus*, Kieff., *Tridymus pyricola*, Marchal, *Inostemma pyricola*, Kieff., and *Chasmodon apterus*, Nees. Poultry and other birds also destroy the larvae. A noticeable check is exercised by a disease that begins to appear at the time when the larvae abandon the pears. A discolouration is produced similar to that in larvae infected by *Botrytis tenella.* All these causes result in a larval mortality of over 80 per cent.

The control measures recommended include collection of infested pears ; the application of heavy tar-oil to the soil a few days before the larvae leave the fruits, the effect of this treatment lasting for about a week ; and digging over the soil in July to expose the cocoons to air and sunlight, and also in spring, when the flower-buds are beginning to swell, as this causes the adults, which only live for about four days, to emerge so that they die before being able to oviposit in the blossoms. Infections with *Botrytis tenella* were highly successful in the laboratory, but failed in practice.

Pax (F.). **Das Ende der Nelkenwickler-Kalamität in Breslau-Hundsfeld.** [The End of the Outbreak of the Carnation Tortricid at Breslau.]—*Anz. Schädlingsk.*, v, no. 12, pp. 155–157, 4 refs. Berlin, 15th December 1929.

As a result of the severe infestation of carnations by *Tortrix pronubana*, Hb., at Breslau in 1928 [*R.A.E.*, A, xvii, 134], the growers concerned destroyed all carnation plants in the open and cultivated other plants in the greenhouse affected. No trace of the moth could be found in October 1929. In the open it had probably failed to survive the severe winter, though experiments have shown that the larvae can resist a temperature of $-25°$ C. [$-13°$ F.] for several days.

Borchert [A.]. **Investigations on the Occurrence of** *Acarapis externus* **in healthy Stocks.**—*Bee World*, x, no. 11, p. 149. Camberley, Surrey, November 1929.

In addition to living in the body of the bee and causing acarine disease, the mite, *Acarapis woodi*, Rennie, is also known to be widespread in bee colonies, living apparently harmlessly on the outer surface of the bee's body. The question as to whether the external form [for which the name *A. externus* has been proposed (*cf. R.A.E.*, A, xvii, 286)] is a harmless species distinct from *A. woodi* or whether its presence represents the beginning of tracheal infection has been much discussed, and has given rise to conflicting views. The author has attempted to solve the problem by examining large numbers of bees from heavily infested colonies in Germany during 1927–29. From 43,868 bees examined in all, large numbers of external mites were obtained, but in no single instance were mites in any stage, or signs of their previous presence, observed in the tracheae. It is not known where these mites live and breed ; they increase considerably during the winter rest. Until further information is obtained, the external mite cannot be regarded as a pathogenic organism, and it has been shown to be at any rate biologically distinct from the tracheal mite ; the author does not, however, deny the possibility that the one species may pass over into the other.

Appel (—). **Die Arbeit der Biologischen Reichsanstalt im unterelbischen Obstbaugebiet.** [The Work of the Imperial Biological Institute in the Fruit-growing Districts on the Lower Elbe.]—*Arb. biol. Reichsanst.*, xvii, no. 5, pp. 385–390. Berlin, November 1929.

The bulk of this report is devoted to *Psylla mali*, Schmidb. (apple leaf sucker) [*R.A.E.*, A, xvii, 483, 484].

SPEYER (W.). **Die klimatischen und parasitären Faktoren im Ursachenkomplex der Obst-Fehlernten an der Niederelbe.** [The climatic and parasitic Factors in the Complex of Causes of the Crop Failures on the Lower Elbe.]—*Arb. biol. Reichsanst.*, xvii, no. 5, pp. 423–434, 1 chart, 11 refs. Berlin, November 1929.

Orchard pests found on the Lower Elbe include the Psyllid, *Psylla mali*, Schmidb., and *Anthonomus pomorum*, L., on apples; *Lecanium corni*, Bch., and *Paratetranychus pilosus*, C. & F., on plums; and the winter-moths, *Cheimatobia brumata*, L., and *Hybernia defoliaria*, Cl., attacking all fruit trees. Over the whole area it is estimated that *P. mali* causes an average crop loss of 30 per cent. on apple, and the other species (taking the two moths together) 5 per cent. each on their respective food-plants.

SCHWARZ (O.) & TOMASZEWSKI (W.). **Untersuchungen über das Auftreten der Gräserkrankheiten im Randowbruch. (Vorläufige Mitteilung.)** [Investigations on the Occurrence of Diseases of Grasses in the Randowbruch District.]—*NachrBl. deuts. PflSch-Dienst*, ix, no. 12, pp. 99–101, 4 refs. Berlin, December 1929.

White ear disease has caused a constant decrease of the seed-crop of meadow grasses (up to 75 per cent. in the case of *Poa pratensis*) at the Randowbruch seed centre, Germany, in recent years. An investigation of the causes was made in 1929 on a wide basis, although *P. pratensis* and *Phalaris arundinacea* are the chief grasses grown for seed. In the production of complete white ear, it is probable that Rhynchota play a larger part than that believed by Kaufmann [*R.A.E.*, A, xiii, 396] and others, for both Capsids and Cercopids were in many cases abundant. Still commoner, however, were instances in which pests and traces of their injury were absent, and these observations and those of other workers on the influence of geological, climatic, and other factors seem to indicate that white ear is a symptom produced by a variety of causes. Far more harm has been caused of recent years by larvae of gall-midges that destroy the reproductive organs in the flowers. Cecidomyiid larvae also occurred in August in the stalks of *Phalaris arundinacea* and *Calamagrostis epigeios*, and *Oscinella* (*Oscinosoma*) *frit*, L., was found particularly on *Poa pratensis*, *Phalaris arundinacea*, and *Agrostis alba*. *Phleum pratense* was infested by the larvae of *Amaurosoma*.

HOUBEN (J.). **Normierung der Obstbaumkarbolineum.** [The Standardisation of Fruit-tree Carbolineum.]—*NachrBl. deuts. PflSch-Dienst*, x, no. 1, pp. 2–3. Berlin, January 1930.

Examinations of various German and foreign brands of fruit-tree carbolineum by the Imperial Institute for Agriculture and Forestry have yielded results warranting the establishment of standard requirements. Such preparations must be of a uniform fluid nature and must form 10 or 15 per cent. emulsions with distilled water that must not disintegrate when allowed to stand for 72 hours. The carbolineum should contain at least 60 per cent. of coal-tar oil, of which at least 20 per cent. must boil at over 270° C. [515° F.]; all other components must be substances known to be harmless. It must not contain more

than 15 per cent. of acid oils, and not more than 4 per cent. of organic bases. Methods of testing tar-distillates to show whether they satisfy these requirements are described.

Speyer (W.). **Fliegenmaden an Steckrüben, Bohnen und Meerrettich.** [Fly Maggots on Swedes, Beans and Horse-radish.]—*NachrBl. deuts. PflSchDienst,* x, no. 1, pp. 3–4, 1 fig. Berlin, January 1930.

Cases of severe infestations by Anthomyiid larvae occurred in June 1929 in the Stade district on the Lower Elbe, when *Phorbia* (*Chorto-phila*) *trichodactyla,* Rond., completely destroyed swedes in seed-beds and caused extensive damage to germinating beans. Maggots found in the stems of horse-radish were determined as *P.* (*C.*) *floralis,* Fall. Differences observed in the characters of the anal area of the larvae of *P. trichodactyla* from beans and from swedes are discussed ; similar differences have been found in previously published figures.

Bodenheimer (F. S.). **Studien zur Epidemiologie, Oekologie und Physiologie der afrikanischen Wanderheuschrecke** (*Schistocerca gregaria* **Forsk.**).—*Z. angew. Ent.*, xv, no. 3, pp. 435–557, 55 figs. Berlin, P. Parey, December 1929. Separates, *M*.8.

The recent invasion of Palestine by *Schistocerca gregaria,* Forsk. (desert locust) afforded an opportunity for the staff of the Hebrew University, Jerusalem, to investigate some aspects of the locust problem, and the results of these investigations are presented in this paper.

The larvae and adults of all locusts are much more resistant to external factors than the eggs, and the greatest mortality must occur in the egg stage. Laboratory experiments showed that the vital optimum is at 30° C. [86° F.] and 100 per cent. relative atmospheric humidity. Temperatures remain favourable between 25·5 and 33° C. [77·9–91·4° F.], while the humidity must always be very high. The less mature eggs are more susceptible to deficient humidity. Below 18° C. [64·4° F.] no development takes place. To ensure the conditions favourable for the development of eggs in the field, the rainfall must be sufficiently abundant and coincide with the period of oviposition, the soil must be thoroughly soaked to the depth of 4 ins. during at least the first half of the development period, and the temperature of the soil must reach a daily average of 25–34° C. Under such conditions the mortality of eggs is very low, and an outbreak can develop if two favourable years occur in succession.

The regularity of the periodicity of outbreaks is illusionary; in Palestine the years of outbreaks were 1865–66, 1878, 1890, 1892, 1899, 1902, 1908, 1915, 1928–29. There seems to be an 11–13 years' period, but this is probably connected with the corresponding climatic periods dependent on the fluctuations of the sun-spots.

The causes of the dying out of locusts in invaded countries are briefly discussed. The invading swarms, which usually arrive in Palestine in spring, are already sexually mature. They lay eggs, and hoppers hatching from them reach the adult stage, but locusts of the second generation have never been observed to propagate further, and either die out or disappear in the desert. The locusts that died in

Palestine in October—December 1928 were still reddish-brown, *i.e.*, apparently sexually immature. Their disappearance could scarcely have been due to cold, since frosts in the coastal zone begin very late in winter, and the locusts began to die out simultaneously in Tel-Aviv, Jerusalem and Jericho, in spite of their very different climates. Observations by the author have proved that at temperatures under 20° C. [68° F.] the locusts do not feed, and their oxygen consumption becomes very low. This must mean that even moderately low temperatures make them less resistant to unfavourable conditions. It would appear, therefore, that the minimum temperatures in the permanent breeding areas of *S. gregaria* must be above 20° C. during the coldest months of the year, for a combination of cold and wet weather is particularly unfavourable to the adults.

The body temperature of locusts is the same as that of the surrounding air if there is no direct sunshine. Under the influence of the direct rays of the sun, the body temperature increases rapidly to above 40° C. [104° F.], even if that of the air is below this figure. This temperature corresponds to the optimum activity. The regulation of body temperature is achieved by changing the position of the body; in the morning, when it is cool, hoppers place themselves at right angles to the rays of the sun, so that a greater absorbing surface is exposed to the latter; at midday they place their bodies parallel to the rays.

Numerous observations were made on the activity of hoppers under field and laboratory conditions, and it was found that their activity depends on the temperature of the air, and that mass-movements can be explained by reflexes. Other chapters contain observations on the respiratory metabolism of locusts, and descriptions of stages and moults, and of oviposition.

Stomatorrhina (*Idia*) *lunata*, F., and *Phorbia* (*Chortophila*) *cilicrura*, Rond., were bred from egg-pods of *S. gregaria*, but are considered of negligible value in control.

PRELL (H.). **Ueber die Entwicklung der Bezeichnungsweise für die Flugstämme periodisch auftretender Insekten.** [The Development of Methods for denoting the Flight-strains of periodically occurring Insects.]—*Z. angew. Ent.*, xv, no. 3, pp. 558–564. Berlin, December 1929.

Many injurious insects require several years to develop, and the adults occurring in a given year are not the progeny of the preceding year's adults. The author reviews various published methods of denoting these various broods, which show a progressive improvement in character, and describes his own system of using two figures, the first indicating the number of years required by a generation and thus showing also the total theoretical number of broods involved, and the second being the ordinal number of the individual brood within the total of the theoretically possible broods. The first year after the end of the nineteenth century is the starting year for numbering broods of equal development length, and this makes the ordinal number a direct indicator of a given brood-year. For instance, III/1 denotes an insect with a 3-year cycle, being on the wing in 1901, 1904, 1907, etc., such as *Melolontha pectoralis*, Germ., in Tyrol; IV/4 applies to *M. melolontha*, L., in Tharandt, Germany, where it has a 4-year cycle, being on the wing in 1904, 1908, 1912, etc.

SCHNAUER (W.). **Untersuchungen über Schadgebiet und Umweltfaktoren einiger landwirtschaftlicher Schädlinge in Deutschland auf Grund statistischer Unterlagen.** [Investigations on the Areas of Injury by some agricultural Pests in Germany and the environmental Factors concerned, based on Statistics.]—*Z. angew. Ent.*, xv, no. 3, pp. 565–627, 24 charts, etc., 288 refs. Berlin, December 1929.

Attempts are being made to extend plant protection measures in Germany, hitherto limited to combating existent or imminent outbreaks of pests, to general preventive work. This development must be preceded by an investigation of the environmental factors on which the occurrence of a pest depends. The first step requisite is the mapping out of areas in which injury is permanent or frequent. A system of symbols and shading indicating varying intensities of injury is described. The determination of the areas leads to conclusions as to the factors (such as temperature, moisture, soil, etc.) governing attack. Such information, embodying maps and charts, is given regarding *Blitophaga* sp. on beet, and *Cicadula* (*Jassus*) *sexnotata*, Fall., *Chlorops taeniopus*, Mg. (*pumilionis*, Bjerk.) and *Hylemyia coarctata*, Fall., on cereals.

The areas of infestation by *Blitophaga* coincide only partly with those of beet cultivation. Lasting infestation depends on soil, topography, and possibilities for hibernation, and the weather in March plays an important part and to some extent permits of the prediction of the injury in the following months. *Cicadula sexnotata* is found throughout Germany, outbreaks occurring in the eastern dry region. They depend solely on the direct action of climate, a sequence of dry, warm years being particularly dangerous. *Chlorops taeniopus* is distributed throughout Europe. In Germany the area of injury is that in which summer and winter wheat are grown, climate having apparently no direct influence, and the severity of outbreaks depending chiefly on the condition of the principal food-plant at the moment of the appearance of the fly in spring. The condition of the plants depends on the weather in the preceding autumn and in spring, on the variety, and on the cultural measures adopted. Nitrogenous manures in spring tend to cause the leafy parts to remain soft for too long a period, whereas phosphoric acid rapidly renders the tissues firm.

Hylemyia coarctata is found throughout Germany, but the area of outbreaks does not extend farther south than the zone in which day temperatures of 10° C. [50° F.] and over do not last longer than 5½ months. This seems to be due to the short vegetation periods, which allows oviposition to occur in the interval between harvest and sowing, this being the only time when fresh, loose, ploughed soil is available. Other factors do not appear to have any influence.

GÜNTHER (O.). **Zuckerrübenschädlinge in Argentinien.** [Sugar-beet Pests in Argentina.]—*Z. angew. Ent.*, xv, no. 3, pp. 628–632, 1 fig. Berlin, December 1929.

In May 1929 the organised cultivation of sugar-beet was started in Argentina in the province of San Juan. *Colias lesbia*, F., a well-known pest of lucerne, attacked the beet plants, many of which were completely defoliated. A spray containing 1 lb. Paris green and 2 lb. lime

in 100 gals. water killed the larvae, but one application was insufficient, as up to 6 generations occur during the growing period, the larvae being present on beet from October to February. It is essential that sowing be advanced to the time between May and August so that the plants may be well-grown when infestation begins.

Epicauta adspersa, Klug, also appeared on beet in October and caused sufficient injury to justify spraying.

BRASSLER (K.). *Ptinus raptor* **Str. als Schädling im Bienenstock.** [*P. raptor* as a Pest in Beehives.]—*Z. angew. Ent.*, xv, no. 3, pp. 635–637, 2 figs., 7 refs. Berlin, December 1929.

Various observations are quoted showing that *Ptinus raptor*, Sturm, is a pest in beehives, eating the pollen and thereby injuring the honeycombs. Most of the information is reproduced from an article by L. Arnhardt, "Der Räuber-Bohrkäfer (*Ptinus raptor*, Str.), ein Pollenzerstörer," in *Neue Bienenzeitung*, 1929, pp. 159–160.

DECKERT (W.). **Gedanken anlässlich der Hausbockkampagne in Dänemark.** [Thoughts prompted by the Campaign in Denmark against *Hylotrupes bajulus*.]—*Z. angew. Ent.*, xv, no. 3, pp. 637–638. Berlin, December 1929.

The fumigation of houses with hydrocyanic acid gas against *Hylotrupes bajulus*, L., is now common in Denmark. In the summer of 1929 over 50 buildings were thus treated.

v. LENGERKEN (H.). **Der Australische Diebskäfer** (*Ptinus tectus* **Boield.) als Paprikaschädling.** [*P. tectus* as a Pest of Paprika.]—*Z. angew. Ent.*, xv, no. 3, p. 639, 1 fig. Berlin, December 1929.

Ptinus tectus, Boield., is recorded as infesting paprika pepper [*Capsicum*] in Berlin.

FRICKHINGER (H. W.). **Massenauftreten von Holzläusen.** [An Outbreak of Psocids.]—*Z. angew. Ent.*, xv, no. 3, p. 640. Berlin, December 1929.

The Psocid, *Nymphopsocus destructor*, Enderl., is reported as infesting a small country house in Bavaria in such numbers as to render some of the rooms uninhabitable.

SCHWARTZ (M.). **Was ist angewandte Entomologie ?** [What is Applied Entomology ?]—*3. Wanderversamml. deuts. Entomologen in Giessen* (22.–26. v. 1929), pp. 18–30. Berlin, 1929.

The objects and principles of applied entomology and the qualifications for workers in this branch of science are discussed.

Kuznetzov-Ugamskiĭ (N. N.). **Ueber die Anolocyclie-Erscheinungen bei Pflanzenläusen.** [On the anholocyclic Phenomena in Aphids. (*In Russian*).]—*Rev. zool. russe*, ix, no. 2, pp. 97–110, 5 refs. Moscow, 1929. (With a Summary in German.)

The author discusses the causes of the evolution of anholocyclic phenomena in Aphids, which, he considers, are to be sought rather in present biological conditions than in the geographical changes of the remote past [*cf. R.A.E.*, A, xiii, 477, etc.].

[Reĭkhardt (A. N.), Karakulin (B. P.) & Isachenko (V. B.).] **Рейхардт (А. Н.), Каракулин (Б. П.) и Исаченко (В. Б.). Pests of Timber and their Control.** [*In Russian.*]—Med. 8vo, 60 pp., 16 figs., 1 ref. Moscow, Gosudarstv. sel'skokhoz. Izd., 1930. Price, 60 *kop.*

This booklet is intended for popular use as a guide in the control of pests attacking wood ; the first part deals with insects and the second with fungi. A key based on simple morphological characters is given to the principal species of wood-borers, *viz.*, *Stromatium fulvum*, Villers (*unicolor*, Ol.), *Hylotrupes bajulus*, L., *Codiosoma spadix*, Hbst., *Lyctus linearis*, Goeze, *L. pubescens*, Panz., *Oligomerus ptilinoides*, Woll., *Coelostethus* (*Anobium*) *pertinax*, L., *Anobium punctatum*, DeG. (*domesticum*, Geoffr.), *Sitodrepa* (*Stegobium*) *panicea*, L., *Trypopitys* (*Priobium*) *carpini*, Hbst., *Xestobium rufovillosum*, DeG., and *Ptilinus pectinicornis*, L. Methods for detecting infestation are indicated, and the characters of the exit-holes of the various wood-borers are very briefly discussed, the adults, and in some instances also other stages, being described in each case.

Anobium punctatum is very common in European Russia, Transcaucasia and Siberia west of Omsk. The adults emerge from overwintered pupae in May and early June and oviposit in old exit-holes or on the rough surface of furniture, but never on a smooth or polished surface, the number of eggs laid by a female being 12–40. The larvae hatch in about a fortnight. The duration of their development varies ; at low temperatures they become inactive. Pupation occurs close to the outer surface of the infested wood, the pupal stage lasting two weeks, after which the young adults remain for a time in pupal chambers. The development from egg to adult lasts from six months to two years ; in hot climates two generations occur in a year. The adults probably do not feed, whereas the larvae infest many different kinds of wood. The Trogositid, *Ostoma ferruginea*, L., is predacious on them, and in Leningrad they were parasitised by the Braconid, *Spathius exarator*, L., and in some instances by the mite, *Pediculoides ventricosus*, Newp.

The biology of *Coelostethus pertinax* is very similar to that of *A. punctatum*, but it infests beams, fences, etc., rather than furniture. It occurs in European Russia and Transcaucasia and in Siberia as far east as Irkutsk. In Leningrad the adults emerge in April or May ; eggs are laid in batches of 6–8, chiefly in old galleries. *Xestobium rufovillosum* is found in the south-west of European Russia, infesting old dry deciduous trees and houses built of oak, chestnut or beech. The larval stage may last a year or more, and young adults may remain in the pupal chambers from late autumn till the following spring. Little is known of the bionomics of *Ptilinus pectinicornis*,

which is sometimes very abundant in the south of European Russia, where it infests the timber of deciduous trees and in rare instances that of conifers.

Sitodrepa panicea is a common pest of stored products, but readily infests furniture, willow baskets and books. Each female lays 20–60 eggs; the beetles, which do not feed, are difficult to find before and during oviposition, but are numerous in rooms afterwards, particularly on the windows. The life-cycle lasts 7 months at 17° C. [62·6° F.], but only 2½ months in the summer or in heated rooms. The eggs do not develop at a temperature of between 4 and −5° C. [39·2–23° F.], but remain viable for four months. *Lyctus pubescens* and *L. linearis* seldom occur in Russia, but have been recorded from central and southern parts of European Russia and Transcaucasia. They avoid old and dry wood, preferring planks from freshly cut deciduous trees. The adults of *L. linearis* emerge in May; the winter is passed in the larval stage. *Codiosoma spadix* has only become abundant in Leningrad since 1926; the larvae bore in the walls and floors of houses built of pine or spruce wood, usually in damp corners.

Hylotrupes bajulus is an important pest, occurring in European Russia and Siberia. The adults appear in the second half of summer, and the eggs are laid in cracks of pine and spruce logs. The larval stage lasts about two years, and the life-cycle from egg to adult covers 3–4, but is longer in green than in dry timber. The galleries are considerably wider than those of the other wood-borers, and in some cases infestation in houses escapes attention until the woodwork is hollowed out to such an extent that the whole building collapses.

Stromatium fulvum is abundant in the Crimea and Transcaspia, and especially in the Caucasus. The adults fly at night in June and July and lay their eggs in cracks in wood of all kinds, each female depositing about 200. The larvae hatch in about three weeks; the creaking sound they make while boring in the wood may be heard at a distance of several yards. The life-cycle from egg to adult covers 3–4 years.

The various methods of controlling wood-boring beetles are reviewed, the most satisfactory including treatment by heat and fumigation.

[Korol'kov (D. M.).] **Корольков (Д. М.). Agricultural Pests in the Sochi Region of the Black Sea Area observed in 1926 and 1927.** [*In Russian.*]—*Trudui Sochinsk. opuitn. sel.-khoz. Sta.*, vii, pt. ii, 20 pp. Sochi, 1929.

This popular paper contains a list of insect pests recorded in this part of Georgia during 1926 and 1927, with brief notes on the bionomics and economic importance of some of them. Among the species dealt with in greater detail, *Gryllotalpa gryllotalpa*, L., is especially harmful to tobacco. It has one generation a year, the oviposition period being very protracted. Dissections of numerous adults indicated that they feed also on earthworms, various beetles, and eggs and larvae of a number of insects.

Scolytus (*Eccoptogaster*) *mali*, Bechst., and *S.* (*E.*) *rugulosus*, Ratz., which infest apples, pears, peaches and especially plums, have two generations a year. The adults of the former oviposit at the end of April or beginning of May, and those of the latter in June; adults of the new generation emerge in August and September. The larvae develop throughout December and January if the winter is sufficiently warm; they often hibernate, however, completing development in

spring. Healthy trees are attacked during periods of drought, when their power of resistance has been lowered; the damage caused, however, is usually limited to a partial drying of the bark, as in the period of rainfall that generally follows, the trees regain their power of resistance and the larvae do not develop. Otherwise healthy trees are only killed in cases when the root-system has been weakened by fungi or some other cause. To prevent the infestation of weak trees they should be treated with 4–5 lb. unslaked lime to 3 gals. water, and simultaneously large trap branches should be placed in infested orchards.

Bruchus pisorum, L. (*pisi*, L.) [*R.A.E.*, A, xvi, 219] is widely distributed in this region at different altitudes. The beetles leave the peas for hibernation, which occurs in various sheltered places. In 1926 mass-oviposition began early in May, and in 1927 most of the eggs were laid at the end of the month. The value of sowing peas at different times to safeguard them from infestation depends on the weather and its effect on the activity of the beetles [xvii, 431]; in these two years, however, peas sown as late as the middle or end of May were not attacked. Experiments on the resistance of different varieties of peas to infestation are not considered decisive. A few of the larvae, pupae and adults were destroyed by the mite, *Pediculoides ventricosus*, Newp.

Eurydema ornatum, L. [*cf.* xv, 511] is a very important pest of crucifers, especially cabbage, and occurs at various altitudes, producing three generations a year. The measures advocated are spraying with 4–5 lb. soap in 12 gals. water and hand collection of the adults and eggs; the latter should not be destroyed until any parasites that may infest them have been allowed to emerge and escape.

NAKAYAMA (S.). **A List of the more important injurious Insects in Chosen.** [*In Japanese.*]—*Ann. Agric. Expt. Sta. Chosen*, iv, no. 5, pp. 261–300. Suigen, Korea, 1929. (With a Summary in English.)

Notes are given on the bionomics and control of 50 of the more important insect pests in Korea. They include, in addition to some of the species already noticed [*R.A.E.*, A, xvi, 361, 483; xvii, 705], *Cydia* (*Laspeyresia*) *glycinivorella*, Mats., on soy beans [*Glycine hispida*]; *Platyedra* (*Gelechia*) *gossypiella*, Saund., on cotton; *Zinckenia fasciata*, Cram., *Barathra* (*Mamestra*) *brassicae*, L., and *Scepticus insularis*, Roel., on sugar-beet, etc.; *Heliothis obsoleta*, F., on tobacco; *Apriona rugicollis*, Chevr., *Baris deplanata*, Roel., and *Diplosis* sp., on mulberry; *Aspidiotus perniciosus*, Comst., *Aulacaspis* (*Diaspis*) *pentagona*, Targ., *Rhynchites heros*, Roel., and *Curculio* (*Balaninus*) *dentipes*, Roel., on various fruit trees; and *Rhaphidopalpa* (*Aulacophora*) *femoralis*, Motsch., and *Epilachna niponica*, Lew., on vegetables.

TANAKA (K.). **Notes on** *Chilo simplex*, **Butl.** [*In Japanese.*]—*Insect Wld.*, xxxiv, pp. 42–46. Gifu, 1930.

The rice borer, *Chilo simplex*, Butl., usually has two generations a year in Japan, but near Nagoya, in the province of Honshu, it has been found feeding on *Zizania latifolia* and *Phragmites* and producing three. The larvae from these food-plants differ somewhat in colour from those infesting rice.

TANAKA (K.). **On** *Oxycetonia jucunda*, **Falderm.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, i, pp. 159–164, 5 figs. Tokyo, December 1929.

The Cetoniid, *Oxycetonia jucunda*, Falderm., has one generation a year in Japan, the adults emerging in late April and May and disappearing from the beginning of June. They cause injury to the flowers of *Citrus* and other plants. The eggs are laid at night and hatch in about two weeks. Hibernation takes place in the larval stage, the larvae feeding on decaying vegetable matter.

KOJIMA (T.). **On the Morphology and Biology of the Larvae of three Prioninae.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, i, pp. 165–173. Tokyo, December 1929.

The three Prionids dealt with, all of which breed in dead wood in Japan, are *Megopis* (*Aegosoma*) *sinica*, White, in *Pinus*, *Picea*, *Mallotus* and *Salix*. *Psephactus remiger*, Harold, in *Fagus*, and *Prionus insularis*, Motsch., in the basal parts of dead stems of *Picea*. The first two species require over two years to reach maturity.

NAWA (U.). **On the Life-history of** *Attagenus japonicus*, **Reitt.** [*In Japanese.*]—*Nogaku Kenkyu*, xiv, pp. 255–258. Kurashiki, 1930.

The Dermestid, *Attagenus japonicus*, Reitt., injures woollen yarn and cloth and silk threads in Japan. There is usually one generation a year, hibernation taking place in the pupal stage. The adults appear in May and June and have been observed on flowers of Umbelliferae.

HARUKAWA (C.) & KONDO (S.). **On** *Hylemyia cilicrura*, **Rondani.** [*In Japanese.*]—*Nogaku Kenkyu*, xiv, pp. 449–469. Kurashiki, 1930.

Phorbia (*Hylemyia*) *cilicrura*, Rond., has two or three generations a year in Japan, hibernating in the adult, larval or pupal stage. The adults occur at any time of the year except midsummer, but are most common from March to May. They begin to oviposit probably 30–40 days after emergence and may live as long as 15 weeks. The eggs are laid in cracks in the ground, especially in newly ploughed fields, or on the food-plant, and hatch in 2–9 days, according to the temperature. The larvae attack the germinating seeds of beans, hemp, cucumber, pumpkin, etc., and sometimes bore upward into the stalks. They are most injurious from March to May, and are not found at all at the end of July and in August. They pupate after feeding for 10–13 days, the adults emerging 11–15 days later.

TAKAHASHI (S.). **On the Damage done by Cicadas.** [*In Japanese.*]—*J. Plant Prot.*, xvii, pp. 7–11. Tokyo, 1930.

Near Tokyo, the adults of the Cicadid, *Graptopsaltria colorata*, Stål, suck the sap from the branches of pear trees. Eggs are laid in the branches and also in fruits that have been covered with paper bags, of which 1–5 per cent. are injured. Exposed fruits are not attacked.

TANAKA (K.). **On** *Pterolophia zonata,* **Bates.** [*In Japanese.*]—*J. Plant Prot.*, xvii, pp. 14–17, 1 pl. Tokyo, 1930.

The Lamiid, *Pterolophia zonata*, Bates, is found throughout Japan, where it has one generation a year, hibernation taking place in the larval stage. Pupation occurs in April, the adults, which are nocturnal, emerging two weeks later. The stems of weakened *Citrus* trees are usually infested, but mulberry may also be attacked.

KONDO (T.) & MIYAHARA (T.). **Fruit Borers and a Summary of their Life-histories in Kwangtung, China.** [*In Japanese.*]—*J. Plant Prot.*, xvii, pp. 85–94. Tokyo, 1930.

Cydia (*Grapholitha*) *inopinata*, Heinrich, lays eggs on the surface of apples, the larvae boring into the fruit. It has two generations a year, the overwintered larvae pupating in late May or early June. The adult moths emerge in June and again from the middle of July to the end of August. In 1916, about 90 per cent. of the fruit was injured in some districts, but the damage has been decreased since by the use of arsenical sprays. *C.* (*G.*) *molesta*, Busck, is very destructive to various fruits, particularly young pears. There are three generations a year, the adults appearing in June and July and again in August and at the beginning of September. Arsenical sprays and protection of the fruit with paper bags are employed as control measures. *Eucosma* (*Spilonota*) *prognathana*, Sn., attacks apples, and also rolls the leaves of peach and cherry. It has two generations a year, the adults appearing from the middle of May to June and from July to September. The larvae bore just below the surface of the fruit. In 1926, 70–80 per cent. of the fruit was injured. *Carposina sasakii*, Mats., is also very destructive, but spraying and protecting the fruit greatly decreased the injury. It has two generations a year, hibernating underground in the larval stage. The adults appear in June and July and again at the end of August. *Numonia* (*Nephopteryx*) *pirivorella*, Mats., hibernates in the larval stage in pear buds, the larvae boring into the fruit in spring and causing serious damage. There are two generations a year, the moths occurring in June and August. *Euzophera* sp. attacks indigenous pears, but *Dichochrocis punctiferalis*, Guen., which has two generations a year, prefers imported varieties. *Anarsia lineatella*, Zell., which feeds on peach and plum and has three generations a year, is less destructive than formerly. *Rhynchites bacchus*, L., is very injurious to plums in some districts. It has one generation a year and hibernates either in the adult or larval stage. *Rhynchites koreanus*, Kono, only attacks pears, the adults being found from the end of May to the end of July.

GHOSH (C. C.). **Entomology.**—*Rep. Dept. Agric. Burma 1928–29*, pp. 21–22. Rangoon, 1929.

Insects investigated in Burma during the year 1928–29 included *Anomala antiqua*, Gyll., which attacks ground-nuts [*Arachis hypogaea*], *Sesamum* and *Hibiscus cannabinus* [*R.A.E.*, A, xii, 383], but does not appear to feed on cotton ; a Cecidomyiid causing injury to the ovaries of *Sorghum* ; and *Agrotis ypsilon*, Hufn., on tobacco and potatoes.

RAMACHANDRA RAO (Y.). **Administration Report of the Government Entomologist, Coimbatore, for 1928-29.** –38 pp. Coimbatore [Agric. Res. Inst.], 1929.

Notes are given on a number of insect pests occurring in South India during 1928–29, some of which have been previously noticed [*R.A.E.*, A, xvii, 235–237]. Spraying against *Colemania sphenarioides*, Bol. (Deccan grasshopper) with a combination of Paris green, lime and flour paste gave promising results. A spray consisting of tobacco and soap was effective against *Disphinctus politus*, Wlk., on betel [*Piper betle*] when directed so as to hit the Capsids. In a series of tests with various insecticides against *Scirtothrips dorsalis*, Hood, on chillies [*Capsicum*], the best results were obtained with tobacco infusion. It was found that treatment with sulphur late in the season against *Tetranychus telarius*, L., on hemp affected the quality of the product for smoking. Observations on *Aspidiotus orientalis*, Newst., on tamarind have shown that the shoots become infested before the fruits are formed ; about July when the young fruits begin to develop the Coccids spread to them and multiply until they are entirely covered. Natural enemies include several Chalcids and Coccinellids, and a Nitidulid, *Cybocephalus semiflavus*, Champ., which attack the scale during the later stages of an infestation. *Icerya purchasi*, Mask., was found on wattle [*Acacia*] on one plantation, and also on a number of wild plants on the Nilgiri Plateau. Attempts are being made to introduce the Coccinellid [*Novius cardinalis*, Muls.] against it. *Dactylopius opuntiae*, Ckll. (*tomentosus*, auct.) was introduced into one locality in Madras for controlling prickly pear [*Opuntia*] and has become firmly established. It is doubtful, however, whether its further encouragement is advisable since the plant is of value for hedges and manure. *Ferrisia* (*Pseudococcus*) *virgata*, Ckll., caused local injury to pepper [*Piper nigrum*], even though the plants were not sprayed with Bordeaux mixture [*cf.* xvi, 54]. Males of *Cecidomyia malabarensis*, Felt (pepper gall fly) have now been reared. Unusually severe injury was caused by the Pyralid, *Orthaga exvinacea*, Hmps. (mango leaf webber). Other pests mentioned include *Opatroides frater*, Fairm., and *Scleron latipes*, Guér., on tobacco seedlings, and *Scelodonta strigicollis*, Motsch., on grape vines.

The progress of the campaign against *Nephantis serinopa*, Meyr., on coconut and the work in connection with the breeding of its parasites are reviewed. The parasites released during the year in several localities were 10,000 Bethylids [*Perisierola* sp.], 2,000 Elasmids [*Elasmus nephantidis*, Rohw.], 5,000 Braconids (*Microbracon* sp.), and 500,000 Eulophids.

Outbreaks of *Spodoptera mauritia*, Boisd., on rice occurred in several districts. In campaigns against this pest, it was successfully held in check by handpicking and trenching or by flooding and treating the surface of the water with kerosene ; dusting with calcium arsenate and lime was effective experimentally.

LEEFMANS (S.). **Ziekten en plagen der cultuurgewassen in Nederlandsch-Indië in 1928.** [Diseases and Pests of cultivated Plants in the Dutch East Indies in 1928.]—*Meded. Inst. PlZiekt.*, no. 75, 96 pp. Buitenzorg, 1929.

Many of the pests recorded here were mentioned in previous reports [*R.A.E.*, A, xiv, 520 ; xvi, 190 ; xvii, 290]. Others include *Silvanus*

surinamensis, L., in stored nutmegs; *Dasynus piperis*, China, on pepper; *Exopholis hypoleuca*, Wied., and *Nymphula depunctalis*, Gn., on rice; *Pyrausta salentialis*, Snell., on maize; *Laphygma exigua*, Hb., on onion, and *Prodenia litura*, F. (*littoralis*, Boisd.) on onion and sweet potato; *Valanga nigricornis*, Burm., *Sexava nubila*, Stål, *Brontispa froggatti celebensis*, Gestro, *Parasa lepida*, Cram., and *Setora nitens*, Wlk., on coconut; and *Coptotermes* sp. in mahogany. Coffee was attacked by *Stephanoderes hampei*, Ferr., in Minahassa, and in Celebes by a white scale, *Ceroputo* sp., which was, however, controlled by *Cryptolaemus montrouzieri*, Muls., imported from Java. *Helopeltis* did considerable injury to cacao in Central Java and was not noticeably reduced by the parasite, *Euphorus helopeltidis*, Ferrière, which was abundant locally. A pest of cinchona formerly recorded as *Attacus ricini*, Boisd. [xiv, 520] has now been found to be *A. cynthia*, Dru. (*Samia insularis*, Voll.). *Termes gilvus*, Hag., *Pseudococcus crotonis*, Green, and *P. citri*, Risso, infested kapok.

HAZELHOFF (E. H.). **Bestryding van den witten topboorder. [I] & II.** [The Control of the White Tip-borer of Sugar-cane.]—Mimeographed, 7 & 11 pp. Pasoeroean, Proefst. Java-Suikerind., 1929.

As considerable loss to the sugar-cane crop was caused in Java in 1928–29 by the white tip-borer [*Scirpophaga intacta*, Sn.], it is proposed as an experiment to subject parts of the severely infested plantations to control measures. The method advised is cutting out all infested shoots in cane $2\frac{1}{2}$–3 months old, or in younger cane if infestation amounts to 5–10 per cent. Methods of organising and supervising the work are described in detail.

ZONDAG (J. L. P.). **Waarnemingen en opmerkingen over de djattievlinder (*Hyblaea puera* Cr.).** [Observations on the Teak Moth.]—*De indische Culturen (Teysmannia)*, xiv, no. 19, pp. 805–810, 6 figs., 5 refs. Surabaya, 1st October 1929.

Teak is commonly defoliated by the Noctuid, *Hyblaea puera*, Cram., in the Dutch East Indies, and though the trees are not killed, considerable loss of timber results. Shortly after the onset of the first rains of the West monsoon the moths appear, and the main attack occurs about six weeks later. Ants, monkeys and birds feed on the caterpillars, which are also attacked by various parasites.

VAN DER VECHT (J.). **Over de Middellandsche Zee-fruitvlieg en de maatregelen tegen den invoer ervan in Nederlandsch-Indië.** [The Mediterranean Fruit-fly and the Measures against its Introduction into the Dutch East Indies.]—*Bull. Inst. PlZiekt. Algem. Proefst. Landbouw*, no. 22, 16 pp., 1 pl., 1 map. Buitenzorg, 1929. (With a Summary in English.)

The distribution and host-fruits of *Ceratitis capitata*, Wied., and the possibility of its introduction into the Dutch East Indies are discussed. Since 1922 all imported fruits are subject to examination and must be accompanied by a certificate by an inspector in the country of origin. The permitted ports of entry in the Dutch East Indies are listed.

LIGHT (S. F.). **Notes on Philippine Termites, iii.**—*Philipp. J. Sci.*, xl, no. 4, pp. 421–452, 9 pls., 8 figs., 6 refs. Manila, December 1929.

The third in this series of notes [*R.A.E.*, A, x, 87] deals with *Coptotermes vastator*, sp. n., which is common throughout the Philippine Islands and is responsible for at least 90 per cent. of the damage caused by termites. The soldier has a highly developed cephalic gland throwing out an acid secretion that not only serves as a protection against ants, but is also thought to dissolve lime and mortar and thus enable the termites to gain access to many buildings otherwise inaccessible. The nests are well protected, usually in the ground but sometimes within the timber attacked. Numerous instances of the ability of this termite to build over and around objects to attain food supplies are cited, and as its vulnerable point, in common with all true subterranean termites, is the necessity of maintaining a ground connection, the use of metal termite shields [*R.A.E.*, A, xvii, 730] for buildings is advocated.

MORSTATT (H.). **Krankheiten und Schädlinge der tropischen Kulturpflanzen und deren Bekämpfung.** [Diseases and Pests of tropical cultivated Plants and their Control.]—*Tropenpflanzer*, xxxii, no. 12, pp. 491–500. Berlin, December 1929.

This is a general review of the subject.

JONES (N. L.). **The Protection of Buildings from White Ant Attack.**—*Agric. Gaz. N.S.W.*, xl, pt. 11, pp. 810–812, 2 figs. Sydney, November 1929.

An account is given of the methods employed for protecting buildings against termites, which are similar to those adopted in the United States [*R.A.E.*, A, xvii, 730 ; xviii, 114, etc.]. A frequent point of entry to wall timbers is around chimneys and bricked-in laundry boilers, and a termite shield should be built in below the floor level. When constructing concrete hearths, every few inches of the filling of sand or earth should be sprinkled with creosote to prevent the termites from nesting in them. Bottom wall plates, bearers and joists should be painted with creosote before and after being fixed in position. Wooden foundation stumps should be painted with creosote, and a little of the liquid should be poured into the stump hole before the stump is put in.

WOODHILL (A. R.). **The Apple Root Weevil** (*Leptops squalidus*, **Boh.**) **as a Pest of Citrus.**—*Agric. Gaz. N.S.W.*, xl, pt. 11, pp. 813–817, 8 figs. Sydney, November 1929.

Severe damage to *Citrus* in several orchards in New South Wales was caused in 1928 by *Leptops squalidus*, Boh. This weevil has not previously been recorded as injuring *Citrus* in the State, though it has long been known as a minor pest of apples in the coastal districts. The larvae and adults are briefly described. The eggs are deposited on the leaves early in the summer, as many as 90 being laid by one female. The larvae, on hatching, crawl down the trunk to the roots, on which they feed, cutting deep furrows along the surface. Pupation takes place in the soil, late in the winter, and the adults emerge from

about 1st August to 31st October or later and feed on the leaves and young shoots. If trees, particularly those on river flats subject to flooding, become unhealthy and begin to shed their leaves, the roots should be examined for the presence of the larvae ; this may necessitate digging 3 or 4 feet under the crown of the tree, as very often the surface roots are not damaged. The use of adhesive bands, 2 or 3 ins. wide, placed as high as possible, to prevent the adults from ascending the trees, is recommended. The weevils on the trunks below the bands and those on the ground near the tree should be collected and destroyed at least once a week.

Banding and the collection of the beetles should be begun about mid-July and continued until they cease to emerge. In banding experiments, 65,000 individuals were collected in less than three months, at least 90 per cent. being taken from 800 trees.

Clark (A. F.). **Insects affecting Opossum-skins in New Zealand.**—*N.Z. J. Agric.*, xxxix, no. 4, pp. 260–261, 2 figs., 3 refs. Wellington, N.Z., 21st October 1929.

The export trade in opossum skins from New Zealand, which amounts to some £100,000 annually, is seriously hampered by insect damage occurring to the skins before leaving the country. The insects concerned are *Monopis ethelella*, Newm. [*R.A.E.*, A, x, 632] ; *Trichophaga tapetzella*, L., an introduced clothes-moth found frequently in dwellings and storehouses ; and the beetles, *Dermestes vulpinus*, F., *D. lardarius*, L., *Ptinus fur*, L., and *Anthrenus museorum*, L., all of which are common pests of stored products in many parts of the world. The main damage is due to holes made in the hides by the species of *Dermestes*, of which *D. vulpinus* is the more important. It lays its eggs in some crevice or shelter, and the larvae, after feeding and growing rapidly, sometimes burrow into solid material, such as wood, but usually pupate in a crack or other hiding-place. The period from oviposition to the adult stage under favourable conditions is about 6 to 8 weeks. The insect spreads by short flights and by wandering of the young larvae.

The moths can be controlled by paradichlorobenzene or flake naphthalene, which are more effective if used in a closed space. All the insects can be killed by fumigation with carbon bisulphide, which does not damage the skins. Uninfested skins that must be kept for some time can be protected by being stored at a temperature of 40° F. ; storehouses should be as free as possible from litter and débris.

James (H. C.). **Progress Reports on Coffee Insect Pests.**—*Bull. Kenya Dept. Agric.*, no. 22, 9 pp. Nairobi, 1928.

Most of the information given on *Anthores leuconotus*, Pasc., *Dirphya princeps*, Jord., *Asterolecanium coffeae*, Newst., and *Pseudococcus citri*, Risso, has been noticed from another source [*R.A.E.*, A, xvii, 626].

Muhlberg (J.). **Arrivera-t-on à supprimer radicalement le ver rose ?**—*Bull. Un. Agric. Égypte*, no. 203, pp. 1–3. Cairo, August–September 1929.

In the hope of securing control of *Platyedra* (*Gelechia*) *gossypiella*, Saund., in the Nile Delta region, the author suggests that the fumigation

of cotton stalks, which are kept on the roofs of Egyptian dwellings for use as fuel and provide hibernation quarters for large numbers of larvae, should be made compulsory and, if possible, carried out at the expense of the Government. He believes that the taxes collected on the increased returns secured thereby from the cotton plantations would amply cover the cost.

Ripley (L. B.) & Hepburn (G. A.). **Fruit-fly Control.**—*Fmg. S. Afr.*, reprint no. 61, 5 pp., 1 fig. Pretoria, October 1929.

This is an extract of a paper, read before the South African and British Associations for the Advancement of Science, on the senses of smell and sight in the Natal fruit-fly, *Ceratitis* (*Pterandus*) *rosa*, Karsch. Much research is required before it can be determined which odours attract insects and which repel, and it is not safe to assume that even closely related insects will react in the same way to the same odour; this applies also to sight. The theoretical method of dealing with *C. rosa* is to hang bait-traps in parts of the orchard not bearing susceptible fruit, a repellent liquid being at the same time sprayed on all trees bearing attractive fruit; it is therefore essential to find the strongest attractants and repellents. As ripening fruit and certain fermenting baits, especially wheaten pollard bait, are known to attract both sexes of the fly, some 150 chemicals were tested, many of which contained compounds found in both of these substances; these were mostly pure compounds, such as alcohols, acids, aldehydes and esters, but many essential oils were also included. A number of weak attractants were thus found, but few strong ones; the ester, linalyl acetate, one of the principal volatile constituents of the peach, attracts strongly, but not so strongly as pollard bait. Oil of cloves is almost as strong an attractant as pollard bait, but is not a pure chemical, consisting of a dozen or more compounds. In India, it was found that males only of certain fruit-flies were attracted by this oil, but both sexes of the Natal fruit-fly were equally attracted. Trials are being made with mixtures of various attractants, though at present none of these seems more attractive than certain of their ingredients used alone. It by no means follows that the stronger the concentration the more attractive the bait will be; for example, a very dilute solution of linalyl acetate gives a larger catch than a stronger one, though of course the stronger the concentration the greater is its range of action. It would seem advantageous, therefore, to use the attractant at two strengths: very weak for baiting the traps and very strong for attracting flies to places where there is no susceptible fruit. In searching for repellents, it was observed that substances that actually drove the flies away were scarce, but a fair number, particularly fusel oil used in small quantities, obscured attractive odours so that the fly did not detect them. Oil of verbena and certain substitutes for turpentine had a similar effect. The strongest repellent found was oil of peppermint. Several kinds of alcohol were repellent though some were attractants; oils of citronella and mustard repel weakly; paraffin repelled only when used very strong (in Australia, paraffin is said to attract males only of the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.]). A repellent and obscurant emulsion suitable for spraying fruit trees has finally been made; this contains an emulsified vegetable oil to which several odoriferous substances have been added, and will be tested on peach trees during the summer.

Study of the visual sense of the fly has shown that, though colour-blind, it is extremely sensitive to light intensity, so that a trap should be well illuminated within, and white objects attract more than coloured ones, and shiny ones more than dull. The kind of trap indicated is a heavy, colourless glass jar, about 5 ins. wide and 4 ins. deep, fitted with wires for hanging in trees, with a flat piece of tin suspended between the two wires about 3 ins. above the jar to keep out rain and retard excessive evaporation. The bait must be poisoned, as many flies escape from such jars after feeding.

TURNER (R. E.) **A new Species of *Microstigmus* (Hym. Sphegid.).**—*Bull. Ent. Res.*, xx, pt. 4, pp. 407–408, 1 fig. London, December 1929.

Microstigmus myersi, sp. n., is described from Trinidad, where it is associated with Collembola.

FERRIÈRE (C.). **The Asiatic and African Species of the Genus *Elasmus*, Westw. (Hym., Chalcid.).**—*Bull. Ent. Res.*, xx, pt. 4, pp. 411–423. London, December 1929.

The species of the genus *Elasmus* are parasites of the larvae of small moths, though some species are also known to be hyperparasites. The female appears to search for a caterpillar that is about to pupate, paralyses it by stinging and subsequently deposits a few eggs beside it. The larvae feed externally on the host and pupate without spinning cocoons. Development is often very rapid, and there may be many generations in a year. The species of the genus are of economic importance, as they attack many very destructive pests, though the hosts are only attacked just before pupation, and the female destroys only a few hosts, as the eggs are laid in clusters.

The morphological characters of the genus are discussed, and a key is given to the 24 Asiatic and African species dealt with in this paper. The recorded hosts of these parasites are: *Acrocercops* sp., parasitised by *E. albomaculatus*, Gah., in the Philippines; *Margaronia indica*, Saund., by *E. indicus*, Roh., *Eublemma amabilis*, Moore, by *E. claripennis*, Cam., *Hapalia machaeralis*, Wlk., by *E. brevicornis*, Gah., *Hyblaea puera*, Cram., by *E. hyblaeae*, sp. n., *Nephantis serinopa*, Meyr., by *E. nephantidis* and "*Tinea*" sp., by *E. anticles*, Wlk., all in India; *Earias insulana*, Boisd., and *Platyedra gossypiella*, Saund., by *E. johnstoni*, Ferr., in India and the Anglo-Egyptian Sudan; *Homona coffearia*, Nietn., by *E. homonae*, sp. n., and *Psyche albipes*, Moore, by *E. hutsoni*, sp. n., and *E. ceylonicus*, sp. n., in Ceylon; *Erionota thrax*, L., by *E. brevicornis* in Java and *E. philippinensis*, Ashm., in the Philippines; *Lamprosema diemenalis*, Guen., by *E. philippinensis*, and *Psara stultalis*, Wlk., by *E. brevicornis* in Malaya; *Scirpophaga intacta*, Sn., by *E. zehntneri*, sp. n., in Java; and *Sylepta derogata*, F., by *E. syleptae*, sp. n., in Nyasaland, *E. indicus* in India, *E. brevicornis* in Malaya and *E. philippinensis* in the Philippines. New species of which the hosts are not known are: *E. masii*, from the Seychelles; *E. lamborni*, from Tanganyika; and *E. africanus*, from Nyasaland.

MYERS (J. G.). **Notes on some natural Enemies of** *Plodia interpunctella* **and** *Silvanus surinamensis* **in Australia.**—*Bull. Ent. Res.*, xx, pt. 4, pp. 425–430. London, December 1929.

In this paper, which is supplementary to one already noticed [*R.A.E.*, A, xvii, 267], notes are given on the life-history and habits of some of the natural enemies of dried fruit pests in Australia. The pairing and oviposition of *Microbracon hebetor*, Say, are described. At Mildura (Victoria), the females definitely preferred the larvae of *Plodia* [*interpunctella*, Hb.] for oviposition purposes, although those of *Ephestia cautella*, Wlk., were equally abundant and were readily stung and paralysed, and the punctures sucked by the females. In Western Australia, in a packing-shed severely infested with *E. cautella*, individuals of *M. hebetor* (morphologically indistinguishable from those at Mildura) were found to be parasitising this species in large numbers, and it is suggested that possibly the form found at Mildura constitutes a race confined to *Plodia*. Eggs laid on the 16th March gave rise to adults on 5th April.

Observations on the manner in which the ants, *Iridomyrmex detectus*, Sm., and *I. rufoniger*, Lowne, attack *Plodia* and *Ephestia* are recorded. In the Mildura district a Bethylid, *Cephalonomia* sp., was found to be a common parasite of larvae of *Silvanus surinamensis*, L. (saw-toothed grain beetle). The process of oviposition of the parasite is described. Adults emerged about a month after the eggs were laid. The cocoons are conspicuous among raisins that have been infested with *S. surinamensis*. *Nemeritis canescens*, Grav., is recorded in Western Australia from a packing-shed infested with *Ephestia cautella*, on which it was doubtless parasitic.

BODKIN (G. E.). **A Note of the Utility of Aerial Photography in Entomological Field Work.**—*Bull. Ent. Res.*, xx, pt. 4, p. 431, 3 pls. London, December 1929.

In planning a campaign against *Chrysomphalus ficus*, Ashm., in Northern Palestine, difficulty was encountered in locating the *Citrus* gardens owing to the absence of maps or surveyors, the roughness of tracks used for transport, the impenetrable nature of the cactus hedges present in many gardens and the somewhat inimical attitude of some of the cultivators. An aerial photograph of the areas was therefore obtained, and the operations of the six fumigation outfits were co-ordinated entirely by use of this map. During 1928 every *Citrus* plot was fumigated (the total number of trees being 49,752), and there is no doubt that by adopting this method a great saving in time and trouble was effected.

BARNES (H. F.). **Gall Midges (Dipt., Cecidomyidae) as Enemies of Aphids.**—*Bull. Ent. Res.*, xx, pt. 4, pp. 433–442, 2 refs. London, December 1929.

Vague statements have been made that in certain outbreaks Aphids have been controlled by the larvae of gall-midges, but no exact proofs based on counts of the number of Aphids killed, the fecundity of the

midge compared with that of the Aphid, the appetite of the midge larvae, etc., have been given. With a view to stimulating research along these lines, the species of Cecidomyiids of which the larvae have been reported as preying on or parasitising Aphids are enumerated, and an alphabetical list is given of the Aphids attacked by midge larvae (where the Aphid has not been identified, its food-plant is substituted).

Wilkinson (D. S.). **Seven new Species of Braconidae.**—*Bull. Ent. Res.*, xx, pt. 4, pp. 443–455, 9 figs. London, December 1929.

The new species described are: *Apanteles pistrinariae* from the larva of the Pierid, *Mylothris chloris*, F., in Southern Nigeria; *A. eucosmae* from *Diacrisia mundata*, Wlk., in the Belgian Congo; *A. neavei* and *A. mlanje* in Nyasaland; *A. jujubae* in Bihar and Orissa; and *Microgaster plecopterae* and *Disophrys sissoo* from the Noctuid, *Plecoptera reflexa*, Guen., in the Punjab. *Apanteles pistrinariae nyasaensis*, subsp. n., is described from Nyasaland.

Thompson (W. R.). **On the Part played by Parasites in the Control of Insects living in protected Situations.**—*Bull. Ent. Res.*, xx, pt. 4, pp. 457–462. London, December 1929.

Among the injurious insects against which methods of biological control may be attempted, are many that live in such a way that a considerable proportion of their population is practically inaccessible to parasites and predators, even during the stages when they are attractive to their enemies. Insects of this type are not infrequently transported in their animal or vegetable food materials into other territories, escaping attention during the process of inspection, and develop in their new homes into devastating pests. The Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], the codling moth [*Cydia pomonella*, L.], and the European corn borer [*Pyrausta nubilalis*, Hb.] are familiar examples of this class of pest. Furthermore, in order to be inaccessible to an enemy, the host need not be in what are commonly called protected situations, such as tunnels in the substance of plants or beneath the surface of the soil. The mere fact that it can live in zones in which the parasite or predator cannot survive or to which it is not attracted, or may be present at times when its enemies are not in a stage when they can attack it, constitutes an equally efficacious protection.

In this paper the part played by parasites in the control of insects of this kind is studied with the aid of mathematical methods, and it is concluded that the fact that a proportion of the host population is inaccessible may have an extremely serious effect on the progress of its parasites, even though the parasite reproduces at a rate that enables it to reach the numerical level of its accessible host population in a short time. The fact that a relatively small proportion of the host population is inaccessible may in certain cases completely prevent a parasite from establishing control. Although a high percentage of hosts is destroyed in every generation, the host population may maintain itself at a level corresponding to economic damage or even continue to increase. The total proportion of inaccessible hosts must be very low if control is to occur.

Swezey (O. H.). **Some Aspects of the Evolution of Species among the native Insects of Hawaii.**—*J. Econ. Ent.*, xxii, no. 6, pp. 851–857. Geneva, N.Y., December 1929.

Some account is given of the numerous indigenous insects of the Hawaiian Islands, which furnish a field for the investigation of evolution and for insect-breeding experiments that could tend towards variations and the production of new species.

Essig (L. O.). **Origin of the Bean Weevil,** *Mylabris obtectus* **(Say).**—*J. Econ. Ent.*, xxii, no. 6, pp. 858–861, 3 refs. Geneva, N.Y., December 1929.

Bruchus (*Mylabris*) *obtectus*, Say, which was first recorded as a pest of beans in Rhode Island in 1860, and was proved to breed continuously in stored beans by J. A. Lintner only in 1891, was introduced into California at San Diego in 1769, and has been found in red lima beans taken from ancient Indian graves in the valley of the Ica and the Ancón Necropolis in Peru, the records dating respectively from 1–500 and 1000–1500 A.D. An adult taken from the Ancón beans does not differ in anatomical characters from those of the present day. *B. obtectus* must therefore have been associated with beans in ancient America, and doubtless followed the trails of the northern migration through Central America and Mexico into North America. The beans grown by the Indians, especially those of the south and south-west, must have been regularly subject to injuries by this insect, and are even now more susceptible to attack than the species of beans native to other countries.

Boyce (A. M.). **The Walnut Husk Fly** (*Rhagoletis juglandis* **Cresson).**—*J. Econ. Ent.*, xxii, no. 6, pp. 861–866, 1 pl., 1 ref. Geneva, N.Y., December 1929.

An account is given of *Rhagoletis juglandis*, Cress., which has at present been recorded as injuring only *Juglans regia* (English or Persian walnut), *J. rupestris*, a species indigenous to Arizona and Texas, and *J. hindsi* (Californian black walnut). The history and distribution of this Trypetid in the United States and the nature of the injury it causes are discussed. In some cases eggs deposited in the husks of the walnuts do not hatch, only 50 per cent. in one consignment of infested nuts, 95 per cent. of which showed evidences of attack, being rendered unmarketable. Most of the information given concerning the bionomics and control of the fly, all stages of which are briefly described, has been already noticed [*R.A.E.*, A, xvii, 228, 385]. Recent studies do not bear out the original ones in some particulars [viii, 234]. No larva was observed to descend to the ground by a silken thread, but a few pupae have been found in the husks at harvest time.

de Ong (E. R.) & Huntoon (M.). **Sulfur as an Insecticide.**—*J. Econ. Ent.*, xxii, no. 6, pp. 866–873, 10 refs. Geneva, N.Y., December 1929.

The increasing importance attributed to the insecticidal value of sulphur in the elementary form, especially at high temperatures, is discussed from the literature. The more general use of this chemical is mainly due to improvements in the process of manufacture, particularly in regard to finely ground and precipitated sulphurs.

The latter are becoming available in increasing quantities and at low prices owing to the recovery of sulphur in purification processes. In the course of experiments with lime-sulphur solutions as an ovicide for *Bryobia praetiosa*, Koch, it was observed that, although the ovicidal value was very low, almost all the larvae hatching from treated eggs died when 1–2 days old, whereas mortality among untreated larvae was only 2–8 per cent. Since dust applications of sublimed and ground sulphur had no effect on the larvae and nymphs at 60–72° F., it was concluded that the sulphur precipitating from the lime-sulphur solution was in a more active form than that contained in the dusts. Other experimenters have proved that a certain proportion of free sulphur is in solution in the lime-sulphur solution. The insecticidal action of lime-sulphur is therefore due first to the reducing or oxygen-absorbing power of the sulphide, and secondly to the action of free sulphur. A process recently developed for recovering sulphur in the colloidal and precipitated form from hydrogen sulphide present as an impurity in illuminating gas is described. The paste produced by this process is very adhesive, difficult to handle and slow drying. The sulphur may be used as a paste, or dried at a carefully regulated temperature, the resulting cake, when milled or suspended in water, being extremely finely divided. If overheated in drying, the sulphur fuses and loses its precipitated form and, simultaneously, much of its activity. A table is given showing approximately the comparative size of sulphur particles in various commercial types. The extreme fineness of division of the particle is one of the chief advantages of precipitated sulphur, as it favours adhesion to leaf surface, large coverage, and a very great surface area, which facilitates sublimation. The grey colour of the sulphur recovered in gas purification facilitates sublimation at low temperatures.

An account is given of experiments in which commercial control of *Scirtothrips citri*, Moult., *Thrips tabaci*, Lind., and *Frankliniella occidentalis*, Perg., on orange, was obtained by applications of sulphur dust at the rate of 1 lb. sulphur to each tree on 6th and 22nd May and 11th June 1929. Counts to determine the toxicity of the same applications against the larval stage of *Coccus pseudomagnoliarum*, Kuw. (*citricola*, Campb.) showed a mortality of 85·1–98·5 per cent. on treated twigs and 14·8–75 per cent. on untreated ones. The effect of the sulphur was principally against the crawling stage, little action being noted after the larvae had settled. As the period of emergence is 6–10 weeks, sulphur should be present in toxic amounts over the entire period. To determine the length of time that sulphur dust remained toxic to the larvae, Coccids were transferred to several groups of leaves on which dust had been present for varying periods up to 22 days. Mortality varied from 92·6 to 98·2 per cent., practically irrespective of the interval between the dusting of the leaves and the transfer of the larvae. Some data were also collected indicating that the larval stage of *Saissetia oleae*, Bern., is also susceptible to similar treatments.

ALLMAN (S. L.). **Some Experiments on the Control of the Codling Moth in Australia.**—*J. Econ. Ent.*, xxii, no. 6, pp. 873–878. Geneva, N.Y., December 1929.

An account is given of some of the experiments carried out in New South Wales in 1927–28 for the control of the codling moth [*Cydia*

pomonella, L.], in continuation of the series inaugurated there the previous season [*R.A.E.*, A, xvi, 101]. Formulae are given for 12 different treatments employed, which, with the exception of one consisting of Volck oil, 1 : 60, all contain arsenicals in various dilutions. Treatments were carried out from 20th October to 27th January.

The following is largely taken from the author's summary, the quantities of the insecticides given being those used to 50 gals. of spray : The value of the various treatments was estimated on the basis of the ratio of " stings " to entrances and the percentage of infested fruit. It was found that 60 and 40 oz. lead arsenate were more effective than the normal rate (20 oz.), and the addition of a water soluble arsenate (2 lb. sodium arsenate) and the use of casein-lime spreader increased the effect of the normal spray. Paris green (1 lb. and 3 lb. lime) was more toxic than lead arsenate at the normal rate. The efficiency of lead arsenate (20 oz.) was practically equal in cases of one calyx and 4 cover sprays and of 4 cover sprays only, the difference in infested fruits in the two plots being mainly due to calyx injury. A lowering of the larvicidal efficiency of the lead arsenate was produced by mixture with lime-sulphur, even with the addition of casein-lime spreader, though this was counterbalanced by the ovicidal action of the lime-sulphur and a possible repellent effect. A reduction in the number of sprayings with lead arsenate resulted in a lowering of efficiency. The apparent exception in the case of the omission of the calyx spray is explained by the fact that this would have little effect in building up a deposit of arsenate over the fruit. Two calyx sprays with lead arsenate were inadequate in checking *C. pomonella*, and ultimately resulted in an increased infestation owing to the large number of larvae on the fruit. Volck oil proved to be an efficient ovicide, but had little larvicidal action. Dusting was distinctly inferior to spraying. Only 48·31 per cent. of the larvae that left the fruit reached the bands [*cf.* xvi, 102].

GRAY (G. P.) & KIRKPATRICK (A. F.). **The protective Stupefaction of certain Scale Insects by Hydrocyanic Acid Vapor.**—*J. Econ. Ent.*, xxii, no. 6, pp. 878–892, 1 pl., 2 figs. Geneva, N.Y., December, 1929.

This is a fuller account of work already noticed [*R.A.E.*, A, xviii, 41] on the resistance to hydrocyanic acid gas of *Saissetia oleae*, Bern., and *Chrysomphalus aurantii*, Mask., on *Citrus*.

GRAY (G. P.) & KIRKPATRICK (A. F.). **The Resistance of Black Scale (*Saissetia oleae* Bern.) to Hydrocyanic Acid Fumigation.**—*J. Econ. Ent.*, xxii, no. 6, pp. 893–897, 20 refs. Geneva, N.Y., December 1929.

Experiments carried out in California, in which strains of *Saissetia oleae*, Bern., from the San Gabriel Valley, known as the resistant scale district, and from districts outside this area, were established on seedling orange trees and fumigated simultaneously with hydrocyanic acid under the same covering, indicated that the hardy scale possessed a higher degree of resistance but was not immune. It was possible to kill all the scales with HCN, but only at such a high dosage that safety

to the trees could not be guaranteed under all conditions. The percentages of mortality secured at low, medium and high concentrations were 75, 95 and 100 per cent. respectively with the resistant strain and 100 per cent. in every case with the non-resistant one.

WEBSTER (R. L.) & BAKER (W. W.). **Potato Flea-beetles in Washington *Epitrix subcrinita* Leconte : *Epitrix cucumeris* Harris.**—*J. Econ. Ent.*, xxii, no. 6, pp. 897–900, 3 refs. Geneva, N.Y., December 1929.

Injury has been caused during the past 5 years to potatoes in western Washington by *Epitrix subcrinita*, Lec., and *E. cucumeris*, Harr. Severe damage is caused to the tubers by the boring of the larvae during July, after which the adult beetles attack the foliage in large numbers. Although attack in late July sometimes kills young plants, the main crop is not likely to suffer injury from the adults. Injured tubers show tunnelling or pitting, seldom extending below a depth of 3 mm., as well as surface injury. Tunnels in potatoes caused by *Diabrotica soror*, Lec., are sometimes mistaken for damage by flea-beetle larvae, but are somewhat larger and characterised by a slight depression on the surface of the tuber. Injury by flea-beetle larvae is generally associated with a pimply or even smooth surface [*cf. R.A.E.*, A, xvii, 40]. Although it is evident that *E. subcrinita*, which appears to be responsible for most of the injury, winters in the adult stage, the beetles have rarely been observed in spring before the appearance of the potato plants. Several adults were, however, collected on leaf buds of seedling cherry on 21st April 1929, and some have been seen feeding on maize as late as 20th October. The number of generations is still in doubt. It has been observed that potatoes planted after 15th June escape damage by the main brood, which matures in July, whereas small fields planted in March or earlier may be dug before the development of this brood. Dusting potato foliage has reduced leaf injury, but has not controlled damage to tubers. The most satisfactory dust was a combination of 6¾ lb. hydrated lime, 5 lb. finely ground sulphur and 10 oz. nicotine sulphate, representing an actual nicotine content of 2 per cent., but the cost is very high.

HAGAN (H. R.). **The Fig-insect Situation in the Smyrna Fig District.**—*J. Econ. Ent.*, xxii, no. 6, pp. 900–909, 7 refs. Geneva, N.Y., December 1929.

The annual importation of Smyrna figs into the United States exceeds 20,000,000 lb. Two-thirds of this tonnage consigned in 1927 was inspected and condemned at the port of entry, owing to infestation or contamination by insects. As the result of an expedition to Asia Minor made with the object of developing a method for controlling *Ephestia cautella*, Wlk., and *Plodia interpunctella*, Hb., in dried figs, a brief account is given of the principal insects attacking fig trees and the fruit of Smyrna figs in Turkey, based on observations made between June and August 1928.

Carpophilus hemipterus, L., lived on other crops during early summer, but became particularly abundant in fig orchards about 25th July, attacking sound figs through the large open eye of the fruit as readily as split ones. Only one generation is produced on Smyrna figs, and the mature larvae apparently enter hibernation, as the growers state

that only the first part of the crop is affected. *C. hemipterus* is taken from apples, pears, tomatos, grapes, and cucurbits before the fig crop ripens, all of these being commonly infected with smut [*cf. R.A.E.*, A, xvi, 320]. From 2 to 5 larvae are usually found in each affected fig.

A small Scolytid, which girdles the twigs, was found in many orchards. As it can probably be transported in cuttings, caution should be exercised in the importation of slips of Smyrna figs for experimental plantings. *Cetonia* ? *aurata*, L., is found in the larval stage on the roots of fig trees, and *Prionus* ? *coriarius*, L., was taken in some numbers from the main stem of a poorly conditioned tree below the surface of the ground. *Formicomus ionicus*, Laf., is one of the Anthicids found constantly and in abundance upon the leaves and ripening fruit. These active insects are frequently seen entering the fruit in rapid succession, and doubtless facilitate the spread of smut from an infected fig to others. They were also taken from most vegetable crops, several weeds, ornamental flowers and grapes, on all of which the spores of smut are common. *Coccus hesperidum*, L., was widely distributed but never abundant, and did no apparent damage. *Ceroplastes rusci*, L., which is frequently found upon the leaves and twigs and was very abundant in 1927, when it was common on the fruit as well, is not usually a serious pest. *Cicada plebeja*, Scop., appeared in swarms in the adult stage in July and August, their exit holes above the roots of the figs being numerous in every orchard.

P. interpunctella, which is responsible for a very high percentage of fig infestation, was found infesting figs in the homes of villagers and appeared in the packing plants, where it seems to be more active than in the orchards, about 1st September. The author believes that *P. interpunctella* uses native plants as alternative food-plants between the fig seasons. Its parasite, *Microbracon hebetor*, Say, is reported to control it before the season is over. The adults of *E. cautella*, which is also suspected of utilising alternative food-plants, were found ovipositing upon partly dried fruit, but never on the figs on the trees. The first larvae were brought into the packing plant on 22nd August, and rapidly increased in numbers.

Drosophila sp. was only rarely encountered in Turkey and is not considered instrumental in transmitting souring of Smyrna figs, but *Blastophaga psenes*, L., transmits endosepsis to figs in Turkey during caprification, as it does in California [xvi, 319]. A brief description is given of *Philotrypesis caricae*, L., which is found in caprifigs but not in the Smyrna fig, its life-history being similar to that of *B. psenes*. After leaving the caprifig, where mating takes place, it flies to another of the subsequent crop and begins oviposition. There are three broods annually, corresponding with the fructification cycle of the caprifig. As the adult female never enters the fig, it is not an agent in the pollination of the new crop of caprifigs. The method of oviposition is discussed. The author gives a number of reasons for not considering *Philotrypesis* to be a parasite of *B. psenes* [*cf. R.A.E.*, A, xi, 272]. Its economic importance depends on whether it parasitises *B. psenes*, and thus reduces its numbers, or preoccupies the gallflowers that might otherwise have been available to the latter. Repeated dissections have shown that the larva undoubtedly occurs in the seed capsule. Until more facts are available, every effort should be made to prevent its introduction into the United States. Ants of the genera *Messor* and *Cremastogaster* enter the figs as they are ripening, the former apparently feeding on the sticky exudation of *Coccus hesperidum*.

The ant frequently passes from the scale to the fig and is a potential transmitter of smut spores.

With the possible exception of *C. hemipterus*, which deposits its eggs in the fruit, the principal damage done by insects to figs on the trees is thus due to contamination of the latter by micro-organisms. Analyses of individual lots of figs delivered for packing in the interior of Asia Minor showed an average infestation of endosepsis, which is transmitted by *B. psenes*, of 6·6 per cent., and 5·6 and 2 per cent. of smut and souring respectively, these being possibly transmitted by *C. hemipterus*, *F. ionicus* and *Cremastogaster*.

In an endeavour to bring the figs within the limits of United States tolerance, they were sorted and analysed, diseased fruit being rejected. By this means the analyses were quickly brought up to 90–95 per cent. passable fruit, and the figs were at once placed in sacks and fumigated to kill the eggs of *E. cautella* before they had time to hatch. Duplex vacuum fumigators were used with a charge of 3½ lb. carbon bisulphide to 100 cu. ft., the use of hydrocyanic acid gas on foodstuffs being prohibited by the Government. The vacuum obtained was 27·5–28 inches, and the fumigation period 1½ hours. The figs were loaded and shipped the same day where possible. Figs treated in this manner and shipped from the interior came within the Federal limits, but the purchase and treatment of figs in the city of Smyrna was found to be impracticable. The figs of one grower who fails to ship promptly will spoil the entire shipment, and many Smyrna shippers refused to sort adequately or else allowed their figs to remain overnight uncovered and unsacked after fumigation.

ARMITAGE (H. M.). **Timing Field Liberations of *Cryptolaemus* in the Control of the Citrophilus Mealybug in the infested Citrus Orchards of Southern California.**—*J. Econ. Ent.*, xxii, no. 6, pp. 910–915, 2 charts. Geneva, N.Y., December 1929.

During the season of 1928 more than 40,000,000 adults of *Cryptolaemus montrouzieri*, Muls., were produced and liberated systematically in Southern California, usually at the rate of 10 beetles to a tree, over several thousand acres of *Citrus* infested with *Pseudococcus gahani*, Green, which is successfully controlled by this means. The various factors involved in timing liberations are discussed, and it is concluded that the first beetles should be released between 1st and 15th April, when field temperatures show an average maximum of at least 70° F. and rainfall is low. Liberations may be continued until 15th September. Field experience over a number of years has shown that the beetles at first released increase to controlling numbers in the progeny of the first generation of adults. Since this requires a period of 90 days in spring and 60 days in summer and early autumn, field liberations must be effected during a period that allows 60 days activity after the final liberation.

A secondary maximum production may be prepared in the laboratory to compensate for the ground lost when control measures applied against other insects have interfered with the control of the mealybug by *C. montrouzieri*. Liberations carried out on the lines indicated have given satisfactory results for several years, except when unusually protracted cool weather during April–June has restricted the activities of the beetles.

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Doane (R. W.) & Gilliland (O. J.). **Three Californian Ambrosia Beetles.**—*J. econ. Ent.*, xxii, no. 6, pp. 915–921. Geneva, N.Y., December 1929.

An account is given of the bionomics of the ambrosia beetles, *Monarthrum scutellare*, Lec., and *M. dentigerum*, Lec., infesting oaks, and *Gnathotrichus sulcatus*, Lec., infesting Douglas fir (*Pseudotsuga taxifolia*), and the manner in which they cultivate and feed on the fungi associated with them. *M. scutellare* is found in dying or badly weakened trees of *Quercus agrifolia*, and less frequently of *Q. lobata*. Diseased parts of living trees may be affected, but the beetles are never found in limbs where the flow of sap is normal. As soon as a tree has been cut down, the beetles attack all parts of it. They are sometimes found in the stump as long as two years after a tree has been felled. The system of boring is described. The entrance holes are about $\frac{1}{16}$ inch in diameter and penetrate the sapwood for a distance of about $\frac{1}{4}$ inch. Only one pair of beetles inhabits each complete system, the male excavating the primary tunnels and nuptial chamber, and the female the secondary tunnels in which the eggs are laid. Oviposition may last for 2 months, and a single female may lay as many as 80 eggs. There are two periods of egg-laying, one beginning in March and the other in October. The eggs hatch in 10–12 days, and the larvae immediately begin to excavate their cells. The spring generation of larvae is most abundant in April and May, and the autumn generation in December and January, each requiring 6–8 weeks to mature. The pupal stage, which lasts 8–12 days, is passed in the larval cells. All stages of the beetle are briefly described.

M. dentigerum was only found by the authors in association with *M. scutellare*, but is not quite so widely distributed. It is considerably smaller than the latter, which it resembles in its bionomics, and can be readily distinguished by its smaller galleries, the character of which is described. The fungus cultivated by both these beetles is probably a species of *Monilia*.

G. sulcatus occurs in great numbers on recently felled Douglas fir, the beetles attacking the top and then the trunk of the tree, and subsequently being found in the stumps, where they may continue their borings for many generations. Infestation may be detected by the turret-like structures formed in the crevices of the bark from castings in front of the entrance burrow. From this point a tunnel of $\frac{1}{20}$–$\frac{1}{16}$ inch diameter passes directly through the bark into the sapwood, where the main gallery is formed. The secondary galleries, usually 4 in number, are found only in the sapwood and vary in length from 6 to 10 inches. The larval galleries extend upward and downward from the secondary galleries parallel to the grain of the wood. The entrance tunnel and part of the main gallery is constructed by the male, and the female excavates the brood galleries. The eggs, which are laid in small niches along the secondary galleries, hatch in 7–8 days, the larvae feeding on the conidia of a blue stain fungus, *Ceratostomella* sp., propagated along the walls by the female, and gradually enlarging their cells, in which they pupate. Both conidial and perithecial stages of the fungus were observed in the galleries, the latter causing the blue stain.

Wood from which the bark has been removed immediately after felling is immune from attack by these beetles. Treatment with creosote also protects timber from attack and kills beetles already present. Experiments in which the holes were plugged up with wooden

pegs or wire nails showed that the beetles soon find their way to the surface by continuing a secondary gallery until they reach the bark, or by changing the main gallery so as to avoid the plug.

SMITH (R. H.). **Studies on Spray Tank Agitation in the Use of Oil Sprays.**—*J. Econ. Ent.*, xxii, no. 6, pp. 929–934, 1 ref. Geneva, N.Y., December 1929.

The following is taken from the author's abstract: Tests of 18 orchard sprayers with tanks ranging in capacity from 200 to 465 U.S. gallons, with agitator paddles of various kinds and sizes ranging in number from 3 to 5 per tank, and with agitator speeds ranging from 60 to 300 r.p.m., indicated that the speed of the agitator is the most important factor in efficient agitation in the use of oil sprays. With the average equipment, a speed of 225 r.p.m. was sufficient to maintain a uniform mixture of pure oil and water. In view of the fact that the so-called quick-breaking emulsions commonly contain much unemulsified oil, that the oil in dilute spray quickly rises to the surface if the agitation is interrupted, and that stable emulsions, including miscible oils, tend to break when used with hard water, an agitator speed of approximately 225 r.p.m. is believed to be advisable for oil sprays. Tables are given showing the effect of emulsifiers, size and number of paddles and agitator speed on the uniformity of the mixture of oil and water. An improved method is given for determining the strength of oil sprays.

THOMPSON (B. G.). **Dusting for Codling Moth Control in the Willamette Valley, Oregon, 1927-1928.**—*J. Econ. Ent.*, xxii, no. 6, pp. 934–936. Geneva, N.Y., December 1929.

Dusting with lead or calcium arsenate was effective when carried out under favourable conditions in controlling the codling moth [*Cydia pomonella*, L.] during two years of experimental work in certain apple orchards in Oregon. As the results were more favourable than those obtained elsewhere in the North-western States by other workers, it is thought that local conditions may have had an important influence. One calyx and four cover applications of dust consisting of 15 per cent. lead arsenate or 13·3 per cent. calcium arsenate gave better control of the larvae than a calyx and three cover treatments with sprays of the same insecticides at the rate of 2 lb. to 100 U.S. gals. water. The dust was applied with a power duster during the night or early morning, operations starting about midnight and lasting till sunrise or longer according to weather conditions. Under very favourable conditions dusting was continued for 15 hours. No attempt was made to dust when conditions were unfavourable.

MOTE (D. C.), WILCOX (J.) & HILLS (O. A.). **The Strawberry Crown-moth in Oregon.**—*J. Econ. Ent.*, xxii, no. 6, pp. 936–943, 1 pl., 1 fig., 14 refs. Geneva, N.Y., December 1929.

Aegeria (*Synanthedon*) *bibionipennis*, Boisd. (*rutilans*, Edw.), the history and synonymy of which is discussed, is a major pest of strawberries of long standing in Oregon [*R.A.E.*, A, xvi, 106]. Whereas it originally attacked only older plants, it has recently invaded one and two-year old plantings and effected considerable reduction in the crop.

Observations of its life-history were begun in 1927 and continued on a more extensive scale in 1928. All stages are described. The injury is caused by the larvae entering the crown at its base. In some cases only one tunnel is made through the centre of the crown, but more often the crown is reduced to a mere shell filled with frass. Occasionally 2 or 3 larvae are found in one crown. Injured plants generally begin to wilt as soon as the ground dries in early summer. Hibernating larvae begin to feed again about the middle of May. An infested plant is usually killed at the end of 2 or 3 seasons.

The activities of the young larvae were studied by means of digging up at various intervals plants previously infested with eggs of a known date. The eggs are usually found on the dead leaves at the base of the plant, or sometimes on the crown itself. On young plants the eggs are sometimes laid on the lower surface of the green leaves. The average length of the incubation period is 14·38 days. The larvae work down under the ground on the outside of the plant and enter the crown when about 30 days old ; about 1st October they spin cocoons and remain inactive until the following spring. After a period of renewed activity, they enter the pre-pupal stage which lasts about 9 days, the pupal stage requiring 23 days. In 1928 the adults began to emerge about 1st June, and all had emerged by mid-July. They are active only in bright sunshine, mating and oviposition following quickly after emergence under suitable weather conditions. Dissections of mature pupae showed as many as 429 eggs in them. The method of oviposition is described. The moths were present in 1928 from early June to mid-August, and oviposition probably continued throughout the whole period.

DOZIER (H. L.) & BUTLER (H. G.). **Notes on the Rearing of** *Ascogaster carpocapsae,* **a Braconid Parasite of the Codling Moth.**—*J. Econ. Ent.*, xxii, no. 6, pp. 954–957. Geneva, N.Y., December 1929.

Ascogaster carpocapsae, Vier., is the most abundant parasite of the codling moth [*Cydia pomonella*, L.] in Delaware. Experimental rearing of this Braconid, carried out on a small scale and not beyond the emergence of the first brood of adults, indicated that the average lengths of the incubation and larval feeding periods of the host were in no way retarded by parasitism, being, if anything, slightly accelerated. The average length of time required for the incubation of eggs of *C. pomonella* exposed to the parasites was 5·6 days. The average feeding period of the host larvae was 14·5 days and the average length of time from the termination of the feeding period to the emergence of the adult parasite was 17·3 days, giving a total of 36·4 days for the complete development of the parasite, if one day is deducted from the egg stage of the moth to allow for parasitisation. In almost all cases the host larvae spin cocoons, but fail to pupate.

BARNES (D. F.) & POTTS (S. F.). **Adherence of some insecticidal Dust Materials to growing and mature Foliage.**—*J. Econ. Ent.*, xxii, no. 6, pp. 957–965, 1 ref. Geneva, N.Y., December 1929.

An account is given of studies carried out in Massachusetts in 1926 and 1927 on materials likely to increase the adhesiveness of dust insecticides. The dusts tested were prepared by mixing lead arsenate and calcium arsenate, with or without the addition of lime, with various

quantities of oils. Light pressed fish oil, described as drying oil, and 3 grades of machine oil, termed non-drying oils, were used. The dusts were placed in a home-made ball mill, and the oils added slowly and stirred. The mixtures were ground with stones for 15 minutes and then passed successively through 4 mesh and 20 mesh screens. The oil in the mixtures rendered them rather coarser than untreated arsenate, and caused them to settle more readily, but those containing more than 10 per cent. oil by weight were moist and screened slowly.

Several varieties of oak were treated at the rate of 5 lb. to $\frac{1}{6}$ acre, and the effectiveness of the dusts was determined by a study of the relationship of the quantities of the insecticide retained on the foliage to records of humidity, fog, dew, temperature, rainfall and wind velocity. In the final collection of leaves in the first experiment in 1926, after an exposure of 2 months and a rainfall of 6·11 inches, only a trace of untreated lead arsenate remained, whereas 50 per cent. of the 17 per cent. fish oil-lead arsenate dust was found still on the foliage. In a further experiment the machine oil dusts, though showing increased adherence as compared with untreated lead arsenate, were less adhesive than fish oil dust. A dust containing 7 per cent. fish oil and 2 per cent. cedar oil retained as much arsenic as a 9 per cent. fish oil dust. These tests indicated that the adhesive quality of the mixtures depends in part upon the drying quality of the oil and in part upon the quantity of oil used. The tendency shown by these oil-coated dusts to heat when exposed to the air was overcome by placing the dust in tight containers immediately after mixing and then storing in the shade.

Additional tests in 1927 showed that whereas 65 per cent. of the original deposit of freshly mixed 17 per cent. fish oil-lead arsenate remained on the foliage 37 days after dusting, a similar dust stored for 7 months gave little better results than untreated lead arsenate (34 and 29 per cent.). The addition of hydrated lime to lead arsenate and to fish oil-lead arsenate dusts gave poorer adherence than untreated lead arsenate. The degree of adherence of calcium arsenate was less than 10 per cent. with or without fish oil or lime. A test to determine the relative adherence of fish oil-lead arsenate dusts to wet and dry foliage showed that the wind removes much of the original deposit from foliage dry at the time of dusting and remaining dry, so that the loss during the first rain is increased. If wet by dew or fog during or immediately after application and allowed to dry, the dust becomes fixed upon the surface like a spray residue. The first inch of rain following dusting removes about 70 per cent. of untreated lead arsenate from the foliage and the first $\frac{1}{2}$ inch removes more than any inch of rainfall following.

The control of the gipsy moth [*Porthetria dispar*, L.] during the month of its life-history when it is susceptible to arsenicals may be maintained by keeping the foliage covered with lead arsenate at the rate of 0·5 mgm. to 10 square inches of leaf surface. When the concentration falls below 0·3 mgm., another treatment is necessary. Leaf expansion and weathering working together reduce the concentration. In tests with 17 per cent. fish oil-lead arsenate and lead arsenate alone expansion and weathering combined reduced the deposit to an average of less than 0·5 mgm. in 6 days, whereas 16 days would have been required to produce this result by either expansion or weathering alone. In 6 days the leaves doubled their size, and in 16 days they increased about 10 times. In the first 6 days with 0·71 in. of rain the loss by weathering proceeded more rapidly than it did for the 16-day period when 1·10 inches of rain fell. The loss by weathering with fish oil dust was less

than with untreated dust, but in 16 days, when the foliage was fully expanded, the loss in both plots was about equal. This was probably due to the splitting off of the dried oil-coated particles from the expanding leaf, aided by the shedding of the downy pubescence, the finely divided uncoated lead arsenate being less affected.

SIEGLER (E. H.), BROWN (L.), YOTHERS (M. A.) & YETTER (W. P.). **A second Report on chemically treated Bands for the Destruction of Codling Moth Larvae.**—*J. Econ. Ent.*, xxii, no. 6, pp. 966–972, 1 ref. Geneva, N.Y., December 1929.

The following is taken from the authors' abstract and summary of a report on experiments additional to a series begun in 1926 in the use of bands impregnated with beta-naphthol against the larvae of *Cydia* (*Carpocapsa*) *pomonella*, L. [*R.A.E.*, A, xvi, 121]. The incorporation of a red engine type of oil with beta-naphthol in 1927 was found to be an improvement over the powder application employed in 1926, when the action was slow and difficulty was experienced in keeping a sufficient coating of the material on the bands. The oil appeared to be of benefit both as an insecticide and as a mechanical carrier for the beta-naphthol, increasing the rapidity of the kill. A crepe paper band coated with beta-naphthol and oil proved more satisfactory than other types of bands treated with these substances, holding more of the coating under humid conditions and being less liable to injure the trees than any other type of band.

A satisfactory coating of the mixture will not be obtained unless a sufficient proportion of beta-naphthol is used in the formula and maintained during the process of treatment. A mixture of 1 lb. beta-naphthol and $1\frac{1}{3}$ U.S. pints lubricating oil was found to be adequate, and the substitution of $\frac{1}{4}$lb. lime for $\frac{1}{4}$lb. of the beta-naphthol aided in maintaining the coating, although it retarded the rapidity of the kill. The maintenance of the coating depends partly upon the amount of rainfall, or upon the degree of evaporation of the oil under high temperatures. An impregnation method of applying the chemicals to the bands was adopted in 1928 as a substitute for smearing on the mixture. By this method it was found possible to coat the inner surface of corrugated paper, a material that proved highly efficient in trapping the larvae of *C. pomonella*. Although no injury to the trees was observed after treatment with chemically treated bands, it is not recommended to use them at present except on an experimental scale.

GROSSMAN (E. F.). **Diluted Calcium Arsenate for Boll Weevil Control.** —*J. Econ. Ent.*, xxii, no. 6, pp. 972–974. Geneva, N.Y., December 1929.

Additional experiments conducted in 1928 in the control of *Anthonomus grandis*, Boh. (cotton boll weevil) with equal quantities of calcium arsenate and hydrated lime confirm a series of tests carried out during 1924–26 [*R.A.E.*, A, xvi, 524]. The four years' results are shown in a table. The average yield from plots of cotton dusted with diluted and undiluted calcium arsenate was almost identical throughout, and in view of the reduced cost of treatment with the diluted mixture, and the fact that no mechanical difficulty is attached to its preparation, it is recommended for use.

Plank (H. K.). **Nematodes parasitic on** *Diatraea saccharalis* **Fabricius in Cuba.**—*J. Econ. Ent.*, xxii, no. 6, pp. 982–983, 2 refs. Geneva, N.Y., December 1929.

Hexamermis meridionalis was found very occasionally parasitising larvae of *Diatraea saccharalis*, F., in Cuba in May and June 1927 and July and September 1928; it is probably of little significance in the control of the moth. *Cephalobus ? elongatus* was recovered from a larva found dead in its tunnel on 18th July 1927. This is the only known record of a species of *Cephalobus* having been found on *Diatraea*.

Plank (H. K.). **Fungi attacking** *Diatraea saccharalis* **Fabricius in Cuba.**—*J. Econ. Ent.*, xxii, no. 6, pp. 983–984, 2 refs. Geneva, N.Y., 1929.

A list is given of the identified species of fungi hitherto encountered attacking *Diatraea saccharalis*, F., in Cuba, the most abundant of which is *Cordyceps barberi*. The stage of the borer attacked and the period of abundance are indicated in respect of each species, none of which appears to be of any practical importance.

Wakeland (C.). **Codling Moth Larvae parasitised by** *Secodella acrobasidis*, **Crawford.**—*J. Econ. Ent.*, xxii, no. 6, p. 985. Geneva, N.Y., December 1929.

Adults reared from eggs and small larvae frequently found attached to dead larvae of the codling moth [*Cydia pomonella*, L.] in certain apple orchards in Idaho in which the moth is of little importance were determined as a species of *Secodella*, probably *S. acrobasis*, Crwfd. The larva appears to be an external feeder, and the pupa is attached to the remains of the host larva. Chalcids of this genus have been known to attack species of the genera *Argyresthia*, *Polychrosis* and *Rhyacionia*, but do not appear to be of much importance.

Ozols (E.). **Wehl par hessu muschu.** [More about the Hessian Fly. (*In Lettish.*)]—*Latvijas Lauksaimnieks*, no. 24, pp. 755–757, 1 map. Riga, 15th December 1929.

A brief review is given of the outbreaks of *Mayetiola destructor*, Say, that occurred in Latvia in 1929, the loss in the crop of winter rye amounting in some localities to 75 per cent. The average percentage of plants destroyed over the entire country was 8·9 of winter rye and 6·9 of winter wheat.

Ozols (E.). **Linu Kaitekli.** [Flax Pests. (*In Lettish.*)]—*Parsk. Mater. Petisan. Organizac. Darb. Linkopibas Noz. Latvija 1919–1929*, pp. 94–100, 3 figs. Riga, 1930.

Notes are given on the bionomics of *Aphthona euphorbiae*, Schr., and *Longitarsus parvulus*, Payk., in Latvia. They have been successfully controlled on young flax plants by dusting with lead arsenate. Other insects observed on flax were: *Phytometra* (*Plusia*) *gamma*, L., which caused serious damage, *Euxoa* (*Agrotis*) *segetum*, Schiff., *Cnephasia wahlbomiana*, L., *Polia* (*Mamestra*) *pisi*, L., *Calocampa exoleta*, L.,

Heliothis obsoleta, F., *Calocoris norvegicus*, Gmel. (*bipunctatus*, F.), *Lygus pratensis*, L., *Thrips tabaci*, Lind., *T. physapus*, L., *Tetranychus telarius*, L., *Phalonia* (*Conchylis*) *epilinana*, Zell., *Heliothis dipsacea*, L., *Melolontha melolontha*, L. (*vulgaris*, F.), *M. hippocastani*, F., *Gryllotalpa gryllotalpa*, L. (*vulgaris*, Latr.), *Agriotes lineatus*, L., *A. sputator*, L., and *A. obscurus*, L.

Barrett (R. E.). **A Study of the immature Forms of some Curculionidae (Coleoptera).**—*Univ. Calif. Pub. Ent.*, v, no. 5, pp. 89–104, 28 figs., 11 refs. Berkeley, Cal., 1930.

Descriptions are given of the larvae of the following injurious Curculionids: *Pantomerus godmani*, Crotch, *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., *O.* (*B.*) *ovatus*, L., *O.* (*B.*) *rugosostriatus*, Goeze, *Hypera punctata*, F., and *Listroderes obliquus*, Gyll. Brief notes on their food-plants and distribution in North America are included.

Studies of Insect Pests.—*41st Ann. Rep. S. Carolina Expt. Sta. 1927–28*, pp. 43–55, 6 figs. Clemson College, S.C., December 1928.

Notes are given on the insect pests observed in South Carolina, chiefly in 1928, several of which have been previously recorded [*R.A.E.*, A, xv, 629; xvi, 456; xviii, 17]. The red spider [*Tetranychus telarius*, L.] caused considerable damage to cotton in spite of the fact that there were only short intervals of dry weather during the season. In one locality young peach twigs were found to be infested by the oriental peach moth [*Cydia molesta*, Busck], and in another district a few individuals of *Luperodes varicornis*, Lec., were found damaging the blooms and squares of cotton. This is the first record of these two insects in the State, though *L. varicornis* has probably long been present there. The southern corn stalk borer [*Diatraea zeacolella*, Dyar] caused some damage to maize, particularly in the eastern part of the State. Two undetermined thrips were present on cotton when seedling injury occurred early in the season. A description of the more common species is given. The eggs are deposited in the leaf tissue and hatch in 5 or 6 days, the adult stage being reached 7 or 8 days later. Seven generations occurred during the season. Good control is obtained with nicotine sprays, alone or combined with oil emulsion.

A Cerambycid infesting apple in several orchards has killed a number of trees. Preliminary studies indicate that the life-cycle lasts about three years. The larvae tunnel in the roots and occasionally follow them several feet from the tree itself. Observations on the tomato fruit-worm [*Heliothis obsoleta*, F.] indicate that maize is more readily attacked than tomatos growing near it. Many of the eggs on the silks of maize were parasitised by *Trichogramma* sp.

MacMillan (H. G.) & Schaal (L. A.). **A pathological Feature of Flea-beetle Injury of Potato Tubers.**—*J. Agric. Res.*, xxxix, no. 11, pp. 807–815, 4 figs., 14 refs. Washington, D.C., 1st December 1929.

Potatoes in northern Colorado are badly damaged by *Epitrix cucumeris*, Harr. (potato flea-beetle). The adults attack the foliage, but by far the greater injury is caused by the feeding of the larvae on the

tubers. The surface of the tuber becomes marked by the tracks of the larvae, and pimples are developed at the places where the larvae burrow into the flesh, under which are cores or slivers, which are found when the potato is peeled. The points of attack also encourage infection by the organism of scab disease (*Actinomyces scabies*) and by *Rhizoctonia*. Treatment of seed potatoes with mercury compounds does not protect the tubers from attack by the larvae, but the treated ones are seldom infected with scab and do not show much pimpling on the surface.

Wehrle (L. P.). **The Clover-leaf Caterpillar** (*Olethreutes cespitana* **Hübner**) **and the Clover-leaf Tyer** (*Anchylopera angulifasciana* **Zeller**).—*Bull. Cornell Agric. Expt. Sta.*, no. 489, 27 pp., 19 figs., 20 refs. Ithaca, N.Y., 29th January 1929.

An account is given of the synonymy, distribution and bionomics of the Tortricids, *Argyroploce* (*Olethreutes*) *cespitana*, Hb., and *Anchylopera angulifasciana*, Zell. All stages of both moths are described.

Argyroploce cespitana has two generations a year in the vicinity of Ithaca, N.Y., where it has been observed on red clover (*Trifolium pratense*), of which it is a potential pest. The moths of the first generation occur throughout June and those of the second generation during August. The respective life-cycles of the first and second generations are constituted as follows : egg stage about 10 and 8 days ; larval stage 26 and 293 days ; and pupal stage 13 and 16 days. The larva fastens leaflets together and feeds within, eating holes through them. It hibernates in a cocoon formed between the leaflets and resumes feeding after hibernation. In the case of the moth becoming abundant or injurious, it could probably be controlled by cutting the clover in late June or early July.

Anchylopera angulifasciana also has two generations a year in New York, the moths of the first being in flight from mid-May till mid-June and those of the second from late July till late August or early September. The egg stage of the first generation lasts about 10 days and that of the second 8, and the larval and pupal stages of the first generation about 20 and 11 days respectively. The newly hatched larva feeds on the lower surface of the leaf along the side of the midrib under a thin web of silk, all plants of the genus *Trifolium* being apparently subject to attack. Later the leaves are tied together and the larva feeds within, eating out the green part between the veins and leaving a thin layer on the outside. The second generation hibernates in the shelter formed by clover leaflets tied together with silk. The greater part of each generation would be removed by the first and second cuttings of clover.

Cartwright (O. L.). **The Maize Billbug in South Carolina.**—*Bull. S. Carolina Agric. Expt. Sta.*, no. 257, 35 pp., 13 figs., 8 refs. Clemson College, S.C., May 1929.

Investigations on *Sphenophorus* (*Calendra*) *maidis*, Chitt., which often causes severe damage to maize in South Carolina, were conducted from 1926 to 1928. The results are in many cases similar to those already recorded [*R.A.E.*, A, iv, 193 ; xv, 629]., The more severe infestations usually occurred on well-drained sandy loam soil. Dispersal is effected mainly by crawling, although the weevils are capable of flight. If

floods or heavy rains occur, they float on the water and are easily carried along when once washed into a stream. In the laboratory, they survived for over 3 weeks when completely submerged in water. The injury by the adults, which kill young plants up to 3 or 4 ins. high and seriously affect those up to 10 ins., is caused by the weevils piercing the outer sheath and feeding on the heart of the plant. More serious damage is caused by the larvae, which eat their way into the heart of the plant and tunnel in the stalk and tap root. The plants are weakened and their yield affected, but they are not usually killed, unless they are small or infested by several larvae. The maximum number of individuals to reach maturity in one stalk was five. The methods and technique for breeding *S. maidis* in the laboratory are described in detail. The average lengths of the developmental stages for the 3 years under review were, egg 6·51 days, larval 49·15 and pupal 9·86. Weevils removed from pupal cells in November and placed on the surface of the soil burrowed into it and successfully passed the winter.

S. maidis has only one generation a year. The hibernated adults appear about the time the earliest maize reaches a height of from 3 to 6 ins. Emergence may continue from March to mid-June, reaching its maximum early in the latter month. Beetles emerged in numbers at a soil temperature of 75° F., but did not do so below 60° F. Mating occurred shortly after they appeared and oviposition began 10 days later. Most of the eggs were laid under conditions of high humidity and temperature.

Natural enemies are of little importance. They include a wasp, *Cerceris bicornuta*, Guér., which provisions its nest with the adult weevils, and a wireworm, *Aeolus dorsalis*, Say, which has been found attacking the pupae ; undetermined species of fungi killed all stages, both in the field and in the insectary.

Insecticides were found to be of little value in controlling *S. maidis*. Wooden barriers proved effective against the adults, but their use is impracticable owing to their high cost. Crop rotation, provided that the maize is planted at a distance of over 500 yards from previously infested fields, appears to be the only effective measure.

All stages of *S. maidis* are described, and characters are given for distinguishing the adults from those of *S.* (*C.*) *callosus*, Ol., and the larvae from those of *Diatraea zeacolella*, Dyar.

SNAPP (O. I.) & SWINGLE (H. S.). **Life History of the Oriental Peach Moth in Georgia.**—*Tech. Bull. U.S. Dept. Agric.*, no. 152, 16 pp., 3 figs. Washington, D.C., November 1929.

Cydia (*Laspeyresia*) *molesta*, Busck (oriental peach moth) is not a pest of any importance in the peach-growing belt of central Georgia, and is not likely to become so, unless late-maturing varieties are planted, as at present the absence of any food-plant after midsummer, when the peach twigs are hardening and the peach fruit has been harvested, kills off larvae that would otherwise hibernate. In the northern part of the peach belt, however, comparatively heavy infestations have occurred, and the insect is likely to become of considerable importance ; in that area apples are grown and the later generations are able to mature in the fruit and hibernate in sufficient numbers for serious damage to occur in the following season. Details are given of the life-history

and habits of the moth as observed during 1925, when there were seven generations, and 1926, when there were six. A table shows the length of time required for each generation to develop through its stages. In 1925 the complete life-cycle averaged from 24·8 to 40·5 days, and in 1926 from 24·5 to 32·8, the first and last generations taking longer than the others owing to the cooler weather. Only three parasites were observed during these studies, namely, *Lixophaga variabilis*, Coq., *Apanteles* sp., and an undescribed species of *Eubadizon*. Many of the larvae collected in the field were found to be attacked by an undetermined wilt disease.

HUCKETT (H. C.). **A Note on the Habits of** *Hylemyia trivittata* **Stein.**—*Bull. Brooklyn Ent. Soc.*, xxiv, no. 5, p. 294. Brooklyn, N.Y., December 1929.

Flies observed to oviposit on immature heads of wild lettuce (*Lactuca* spp.) during September at Elba, N.Y., have been identified as *Hylemyia trivittata*, Stein. On hatching the larvae fed on the heads. This Anthomyiid is recorded by Stein as occurring in Washington State, and it is a common species in eastern North America.

MOGENDORFF (N.). **" Fern-leaf " of Tomato.**—*Phytopathology*, xx, no. 1, pp. 25–46, 5 figs., 31 refs. Lancaster, Pa., January 1930.

The symptom known as fern-leaf of tomatos is chiefly characterised by a filiform abnormality of part of the foliage. It is of much less common occurrence than tomato mosaic caused by the virus of tobacco mosaic, but has sometimes been found associated with cucumber mosaic in tomatos. In the experiments here described in detail typical fern-leaf symptoms could not be produced with the ordinary tobacco-tomato mosaic virus. It was occasionally obtained by artificial infection with cucumber mosaic, and regularly produced in young plants by the feeding of individuals of *Myzus persicae*, Sulz., transferred from tobacco plants infected with cucumber mosaic. The production of the symptoms appears to be connected with the age of the plant and certain environmental conditions.

SWEZY (O.). **Factors influencing the minimum Incubation Periods of Curly Top in the Beet Leaf Hopper.**—*Phytopathology*, xx, no. 1, pp. 93–100, 3 figs., 3 refs. Lancaster, Pa., January 1930.

Normally the infective organism of curly-top of sugar-beet has to undergo a change, requiring 1–3 days, in the body of *Eutettix tenella*, Baker, before the latter can readily transmit the disease. It is, however, possible for the organism to reach the salivary glands so promptly that it remains unchanged, and it infects a fresh plant at once when ejected with the saliva. That this occurs only rarely is indicated by the small percentage of infection obtaining at intervals of only a few hours. On examination of the intestinal tract of 250 leafhoppers, the author found one in which the food path was blocked with bacteria. Such a condition might explain the occurrence of infection in a short period, since infected beet juice might be ejected from the oesophagus soon after being taken in.

Hoggan (I. A.). **Transmission of Cucumber Mosaic to Spinach.**—*Phytopathology*, xx, no. 1, pp. 103–105, 1 fig., 2 refs. Lancaster, Pa., January 1930.

Cucumber mosaic is readily transmitted to solanaceous plants by *Myzus persicae*, Sulz. [*R.A.E.*, A, xvii, 282] and *Macrosiphum gei*, Koch (*solanifolii*, Ashm.). It has also been found that the disease is easily transmitted by both these Aphids to spinach, from which the virus is again recoverable by the same agency. The symptoms produced on spinach are similar to those of spinach-blight, and this fact, together with the identity of the insect vectors in the two cases, is suggestive of a possible relationship between the two diseases.

Granovsky (A. A.). **Differentiation of Symptoms and Effect of Leafhopper feeding on Histology of Alfalfa Leaves.** (**Abstract.**)—*Phytopathology*, xx, no. 1, p. 121. Lancaster, Pa., January 1930.

Studies of yellow-top disease of lucerne, caused by *Empoasca fabae*, Harr., showed the symptoms to differ from types of yellowing due to other factors, including injury by Aphids. In tissue injured by the leafhopper, microchemical tests revealed a greater accumulation of starch grains and sugars. Histological studies showed phenomena evidently due to enzymic secretions by the leafhoppers.

Leach (J. G.). **Further Studies on the Seed-corn Maggot and Potato Black Leg.** (**Abstract.**)—*Phytopathology*, xx, no. 1, p. 127. Lancaster, Pa., January 1930.

A comparative study was made of the internal bacterial flora of the seed-corn maggot [*Phorbia cilicrura*, Rond.], the principal bacteria associated with blackleg of potato, and certain soil-inhabiting bacteria [*cf.* *R.A.E.*, A, xiv, 269; xvi, 555].

Nutritional studies indicated that bacteria, as such, are not necessary for the growth of the insect, but that they furnish available food by digesting the plant tissues.

Bonde (R.). **Some Conditions determining Potato-seed-piece Decay and Black Leg induced by Maggots.** (**Abstract.**)—*Phytopathology*, xx, no. 1, p. 128. Lancaster, Pa., January 1930.

In laboratory tests, adults of *Phorbia* (*Hylemyia*) *cilicrura*, Rond., caught in the open, did not infect potato seed-pieces by direct contact. Larvae from eggs of such flies deposited in sterilised soil induced decay in potato slices in damp chambers. In seed-pieces in soil, rapid decay was dependent upon shallow lesions caused by various fungi and bacteria, on unhealed surfaces, and upon the entrance of the larvae through such lesions. Thus, with larvae present, decay occurred in freshly cut seed-pieces planted in non-sterilised toil and attacked by fungi or bacteria, but not in suberised seed-pieces planted in non-sterilised soil, or in freshly cut seed-pieces planted, and becoming healed, in sterilised soil. In commercial potato-growing conditions in Maine, the larvae showed a similar relation to seed-piece decay, except that entrance lesions, due to fungi and bacteria, developed largely in storage and not in soil, even on freshly cut seed. *Bacillus phytophthorus* and some other potato-pathogenic bacteria have been isolated from the inside of the puparia. Similar effects were induced with the larvae

of *P.* (*H.*) *trichodactyla*, Rond. Negative results were secured with *Musca domestica*, L., *Trichocera* sp., *Sciara tridentata*, Rüb., and *Drosophila* spp.

BONDE (R.). **The Cabbage Maggot as a disseminating Agent of bacterial Rots in the Cruciferae. (Abstract.)**—*Phytopathology*, xx, no. 1, p. 128. Lancaster, Pa., January 1930.

Turnips grown in the field could be divided into three classes: those with injury by the larvae of *Phorbia* (*Hylemyia*) *brassicae*, Bch., associated with a soft white rot; those without insect injury or rot; and those without rot, but injured by the insect. The last group, however, developed the rot in storage, while turnips without injury remained healthy. The larvae severely damaged Chinese cabbage, burrowing in the roots and the fleshy midribs of the leaves, a soft rot ensuing. Swedes were attacked by the larvae, but rapid decay was not observed in the field. Wild mustard (*Brassica arvensis*) and wild radish (*Raphanus raphanistrum*) were found generally injured at their roots by the larvae. Pathogenic bacteria were often obtained from the slightly discoloured areas near the path of the larvae.

Larvae from the roots of wild radish could produce bacterial decay in slices of turnips and kohlrabi, but did not feed upon and infect potato slices. Pupae found in dry soil were surface sterilised and placed on agar plates until the flies emerged. From the inside of the puparia pathogenic bacterial cultures were secured. Similar cultures have been obtained from inside mature flies caught in the field in early spring, suggesting that the pathogenic organisms hibernate within the pupae.

HOGGAN (I. A.). **Aphid Transmission of Plant Viruses. (Abstract.)**—*Phytopathology*, xx, no. 1, p. 133. Lancaster, Pa., January 1930.

That the virus of ordinary tobacco mosaic is transmitted by Aphids has recently been questioned. Greenhouse trials have now demonstrated that *Myzus solani*, Kalt. (*pseudosolani*, Theo.) and *Macrosiphum gei*, Koch (*solanifolii*, Ashm.) can transmit this virus from tomato to various solanaceous plants, although these Aphids appear incapable of transmitting the same virus from tobacco. They will readily transmit the virus of cucumber mosaic, however, from both tobacco and tomato, as will also *Myzus circumflexus*, Buckt. This latter Aphid also appears unable to transmit the virus of ordinary tobacco mosaic from tobacco, thus resembling *M. persicae*, Sulz. [*R.A.E.*, A, xvii, 282]. No adequate explanation can yet be offered to account for this peculiar selective capacity of the Aphids, with respect to both the virus and the food-plant. It therefore appears that, although *Myzus solani* and *Macrosiphum gei* may be factors in the dissemination of ordinary tobacco mosaic on tomato, none of the Aphids studied is likely to be of importance in its dissemination in tobacco fields.

GOSS (R. W.). **Insect Transmission of Potato-virus Diseases. (Abstract.)**—*Phytopathology*, xx, no. 1, p. 136. Lancaster, Pa., January 1930.

In tests carried out for four years on the ability of various insects to transmit diseases of potatoes, transmission of both spindle tuber and

unmottled curly dwarf was obtained with *Melanoplus* spp., *Epitrix cucumeris*, Harr., *Systena elongata*, F., *Lygus pratensis*, L., and *Leptinotarsa decemlineata*, Say. Spindle tuber was also transmitted by *Disonycha triangularis*, Say. A few tests with *Melanoplus* spp., *E. cucumeris* and *L. pratensis* with rugose mosaic, mild mosaic and leaf-roll were negative.

Taylor (C. F.) & Blodgett (F. M.). **Effect of Pressure in spraying Potatoes with Bordeaux for Control of Leaf Hoppers and Aphis.** (**Abstract.**)—*Phytopathology*, xx, no. 1, p. 136. Lancaster, Pa., January 1930.

In connection with numerous spraying experiments on potatoes, using Bordeaux mixture, 5–5–50, in which different pressures were being compared throughout the season, quantitative records were taken of some of the diseases and insects present. The most interesting from the standpoint of spread of virus diseases were, perhaps, the opposite effects of the spray on the leafhoppers [*Empoasca fabae*, Harr.] and Aphids. In regard to the former, tip-burned leaflets per plant were counted on arbitrarily selected plants. There were most hopper-burned leaves on the unsprayed plots, an average of 163 per plant. At 200 lb. pressure there were 80 less, and at 300 lb. 98 less. At 400 lb. pressure there was an average of 62 less than at 200 lb. The Aphid, however, varied consistently and significantly in the opposite direction. At 200 lb. pressure there were 41 more, at 300 lb. 62 more, and at 400 lb. 72 more per plant than on the unsprayed plants, which averaged 20 Aphids each. Plants with leaf-roll in one field averaged 81 more hopper-burned leaflets per plant than healthy plants. Similar differences in tip-burn between plants suffering from leaf-roll and healthy plants appeared on sprayed and unsprayed plots, though the total number was greater on the unsprayed one.

Quanjer (H. M.), Thung (T. H.) & Elze (D. L.). **"Pseudonet-necrosis" of the Potato.** (**Abstract.**)—*Phytopathology*, xx, no. 1, p. 137. Lancaster, Pa., January 1930.

A necrosis of the internal parenchyma of potatoes is stated to have been transmitted by *Myzus persicae*, Sulz.

Douglas (W. A.). **Caterpillar attacking Soy Beans, controlled by Sodium Fluosilicate.**—*Rice J.*, xxxii, no. 12, p. 24. Beaumont, Tex., December 1929.

The velvet-bean caterpillar [*Anticarsia gemmatalis*, Hb.] caused considerable damage to soy beans [*Glycine hispida*] grown on rice plantations in Louisiana in 1929. This moth is not definitely known to pass the winter in the United States, but is supposed to fly north in summer from Cuba or possibly southern Florida [*cf. R.A.E.*, A, xv, 540]. The eggs are laid on the leaves of the plants, and the larvae attack first the tender foliage and later all parts of the plant, including the stems and pods. The larva, which is briefly described, pupates in the soil, the pupal stage lasting not more than a week in summer. The second generation was found to cause the greatest damage. Flooding

of the rice-fields to kill the pupae has been found unsatisfactory, but shallow cultivation, close to the plants, destroyed many of them. Calcium arsenate and lead arsenate, although toxic to the larvae, also kill the plants, but several fields of soy beans in Louisiana and Texas were saved in 1929 by the timely application of sodium fluosilicate, which is also used against the blister beetle [*Epicauta lemniscata*, F.] on this crop [xvi, 390]. The light grade of dust is cheaper and spreads better. Application should be made at the rate of 10–12 lb. to the acre; slight injury is caused by heavier applications, and scorching results when the plants are moist. Plants should be dusted as soon as any sign of injury appears, and a second application may be needed in the case of a new generation, or an invasion from neighbouring fields.

Robinson (J. M.) & Arant (F. S.). **Dusting Cotton with Calcium Arsenate for Boll Weevil Control. (Second Progress Report.)**—*Circ. Alabama Agric. Expt. Sta.*, no. 53, 15 pp., 2 figs. Auburn, Ala., May 1929.

The tests with calcium arsenate dusts for controlling the cotton boll weevil [*Anthonomus grandis*, Boh.] in Alabama have been continued since the previous report [*R.A.E.*, A, xiv, 491], carrying them altogether over a period of five years. On three different types of soil, the dust was found to result in an average gain of 284 lb. of seed cotton to the acre, each acre receiving 40 lb. of the dust each season. The treatment was successful on either wet or dry foliage, but dusting is only profitable when the infestation exceeds 10 per cent. and when the potential yield is half a bale or more to the acre.

Marcovitch (S.) & Stanley (W. W.). **Cryolite and Barium Fluosilicate: their Use as Insecticides.**—*Bull. Tennessee Agric. Expt. Sta.*, no. 140, 19 pp., 8 figs., 5 refs. Knoxville, Tenn., November 1929.

This is an account of experiments in which various fluorine compounds were tested as possible substitutes for arsenicals. Natural cryolite is a fluoride of aluminium and sodium that is found in Greenland. When ground it is a heavy powder and not well adapted for use as an insecticide. A synthetic form, however, is now available, which is light and uniform and has a solubility of 1 gm. to 1,639 cc. water. It consists of 98·2 per cent. sodium aluminium fluoride, 0·74 per cent. silica, 0·36 per cent. sodium sulphate, 0·06 per cent. iron oxide and 0·64 per cent. moisture. Barium fluosilicate is not a commercial chemical at present, but owing to its promising insecticidal properties several manufacturers are prepared to supply any demand that may arise. Its chief advantages are its low solubility (1 gm. in 3,750 cc.) and consequent freedom from the objection of foliage injury. Both cryolite and barium fluosilicate are less toxic to man than sodium fluosilicate [*cf. R.A.E.*, A, xvi, 393].

In experiments with bran baits containing 0·5 per cent. by weight of the poison against *Melanoplus femur-rubrum*, DeG., the percentages of mortality obtained in 30 hours were 95 with barium fluosilicate, 20 with synthetic cryolite, 100 with sodium fluosilicate, and 0 with magnesium arsenate.

Six applications at weekly intervals of cryolite or barium fluosilicate (1 lb. to 50 U.S. gals. water) did not injure the foliage of peaches or beans, and beans and potatoes were not injured by pure dusts at the rate of 6–12 lb. per acre. The dusts may be combined with a carrier. Combined sprays of $1\frac{1}{2}$ lb. barium fluosilicate or cryolite to 50 U.S. gals. lime-sulphur (1 : 40), or cryolite and Bordeaux mixture, gave good results against the Mexican bean beetle [*Epilachna corrupta*, Muls.] on beans and did not injure the foliage, but scorching was caused by barium fluosilicate and Bordeaux mixture. Spraying with cryolite and barium fluosilicate (1 lb. to 50 U.S. gals. water) and dusting with these materials at the rate of 6 lb. to the acre were also successful against *E. corrupta*. Dusting with either compound once a week for five weeks at the rate of 6 lb. to the acre successfully controlled *Protoparce quinquemaculata*, Haw., and *Epitrix cucumeris*, Harr., on tobacco without injuring the plants. Fish oil (25 per cent. by weight) considerably increased the adhesiveness of the dusts.

Administrative Instructions concerning Mediterranean Fruit Fly Quarantine.—*U.S. Dept. Agric., P.Q.C.A.* [Circular no.] 264, multigraph, 1 p. Washington, D.C., 6th February 1930.

Under these instructions concerning the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], the beginning of the host-free period for cantaloupes, which are classed as fruits, is deferred to 15th June [*cf.* *R.A.E.*, A, xvii, 661].

[Jackson (T. P.).] **Work connected with Insect and Fungus Pests and their Control.**—*Rep. Agric. Dept. St. Vincent 1928*, pp. 8–14. Trinidad, 1929.

The minor cotton pests and pests of miscellaneous crops recorded are the same as those observed in recent years [*R.A.E.*, A, xv, 51 ; xvi, 650]. It is expected that the crop of Sea Island cotton will be a poor one owing to the attacks of *Alabama argillacea*, Hb., during September–November ; in spite of insecticides being available, very little was done to combat it, and rain frequently made dusting impossible. Infestation by *Platyedra gossypiella*, Saund. (pink bollworm) was about normal, the percentage of infestation at the Experiment Station on various dates being shown in a table. The campaign against the cotton-stainer, *Dysdercus discolor*, Wlk. (*delauneyi*, Leth.), consisted of the enforcement of a close season, the trapping of the insects when found in numbers, and the destruction of alternative food-plants. *Hibiscus sabdariffa* was found to attract the stainers during the fruiting period, but it is not known whether the life-cycle can be completed on this plant.

Hardy (F.) & Ross (R.). **Cyanogas Dusting for Froghopper Control.**—*Min. & Proc. Froghopper Invest. Comm. Trinidad & Tobago*, pt. xvii, pp. 399–408. Trinidad, 1929.

Experiments with cyanogas calcium cyanide on a sugar-cane estate infested with the froghopper [*Tomaspis saccharina*, Dist.] in Trinidad, which are described in this paper, have led to the conclusion that dusting with this insecticide can only be considered effective when the first

generation is completely suppressed throughout the area treated. This is practically impossible unless the problem of the grasses harbouring the insect in fields and traces can be solved. Burning the grass in the traces during the dry season might perhaps destroy aestivating eggs. In cases of widespread infestations by the first generation, very large dusting gangs would be required to cope with an outbreak at the correct time, that is, when the majority of nymphs are in the last instar. Better dusting apparatus is also required. It is thought that light-traps would be of value for catching first-generation adults that have escaped destruction. Dry-season ploughing and cultivation of fields that have been infested in the previous year should also be tried, and if possible all infested ratoon fields should be ploughed and left fallow during the dry season before replanting. Where this is not practicable, the soil between the ratooning stools in badly infested fields should be turned over and exposed. Fields containing infested ratoons should never be left abandoned after harvesting the crop.

Hardy (F.). **Tillage and Froghopper Incidence.**—*Min. & Proc. Froghopper Invest. Comm. Trinidad & Tobago,* pt. xvii, pp. 409–420. Trinidad, 1929.

Observations have been carried out on 162 sugar-cane fields showing severe infestation by the sugar-cane froghopper [*Tomaspis saccharina*, Dist.], the results of various treatments being recorded in tables. The indications are that thorough ploughing of previously infested fields is likely to destroy numbers of eggs and thus lessen the infestation for the following year ; this is to be further tested. Meantime ploughing should be as thorough as possible, and old ratoon stumps likely to contain eggs should be stacked and burnt where practicable ; stool shaving, following the reaping of infested canes in fields that are to be left to ratoon another year, might also be tried.

Carmouze (—). **Notice sur l'utilisation de la chloropicrine pour la destruction des fourmis-manioc.**—*Ann. Méd. Pharm. col.,* xxvi, no. 3, pp. 460–463. Paris, July–September 1929.

Chloropicrin was successfully used in the control of ants [*Atta*] attacking cassava and other crops in French Guiana, all stages being destroyed by the injection of 200 cc. into the nest by means of a funnel. The ease and rapidity with which the injection is made renders the use of a mask unnecessary.

Porter (C. E.). **Notas para el estudio de los Tentredínidos de Chile.** [Contribution to the Study of the Tenthredinids of Chile.]—*Bol. Mus. nac. Chile,* xii (1919–29), pp. 20–24, 2 figs. Santiago, 1929.

The sawfly of greatest economic importance in Chile is *Caliroa* (*Eriocampoides*) *limacina*, Retz., a serious pest of fruit trees. The eggs are laid in the leaves and hatch in 1–2 weeks. The larvae feed on the epidermis, and pupation occurs in the soil at a depth of about an inch. There are two generations a year.

Imms (A. D.). **A General Textbook of Entomology.**—Roy. 8vo, xii+703 pp., 607 figs., refs. London, Methuen & Co., Ltd., 2nd edn. revd., 1930. Price, 36*s*.

This second edition [*R.A.E.*, A, xiii, 157] contains various additions and emendations, the most important being revised classifications of the orders Dermaptera, Isoptera and Thysanoptera, additions to the bibliographies at the end of many of the chapters, and notes on recent advances in the subject in the form of addenda.

[Chorbadzhiev (P.).] **Чорбаджиевъ (П.). Bemerkungen über einige schädlichen Insekten auf den Kulturpflanzen in Bulgarien während der Jahren 1928-1929.** [Notes on some Insect Pests of cultivated Plants in Bulgaria in the Years 1928 and 1929 (*in Bulgarian*).]—*Mitt.bulgar. ent. Ges.*, v, pp. 63–106, 7 refs. Sofia, 1930.

Notes are given on 82 species of insect pests recorded during 1928 and 1929 from various parts of Bulgaria, and in many cases on measures for their control. Species recorded for the first time included *Cicadula sexnotata*, Fall., on wheat; *Bostrychus* (*Apate*) *capucinus*, L., on mulberry trees; *Lixus ascanii*, L., on radish; *Ceuthorrhynchus suturalis*, F., on onion leaves; *Homaloplia* sp. on leaves of vines, roses and various fruit trees; *Anarsia lineatella*, Zell., on plums; and *Plagionotus floralis*, Pall., on lucerne. The last named was especially abundant in 1929, the damage caused reaching 30–100 per cent. in many localities. The adults appeared at the end of May and in June and laid their eggs singly in the base of the stems of old lucerne plants. The larvae penetrated the chief root and fed on the inner tissues; they hibernated in the lower part of the root and completed their feeding in April.

Pyrausta nubilalis, Hb., decreased the crop of maize by 50 per cent. in some localities. Two annual generations probably occur in southern Bulgaria and one in the north. Parasites observed were *Microbracon brevicornis*, Wesm., and *Ceromasia* (*Lydella*) *senilis*, Mg.

As a result of the very hot and dry summers of 1927 and 1928, followed by severe winters, and partly owing to the scarcity of the starling, *Pastor roseus*, outbreaks of *Dociostaurus maroccanus*, Thnb., occurred in various parts of southern Bulgaria in 1929. The young adults, which appeared throughout May, attacked cereals, cotton, etc., and in many places the crops had to be resown. Oviposition took place towards the end of June, and mass migration of the swarms occurred in July. A few (1–2 per cent.) of the locusts were parasitised by an unidentified Tachinid. Control measures consisted of driving them on to linen sheets, in which they were enveloped, and then transferring them into sacks, which were thrown into cauldrons with boiling water, or driving them into pits 20–33 ft. in diameter, covering the whole with straw and burning. *D. maroccanus* was sometimes accompanied by *Calliptamus italicus*, L., *Oedipoda coerulescens*, L., and *Oedaleus decorus*, Germ.

Lema melanopa, L., was widely distributed on late sowings of oats and barley, the overwintered adults emerging from the soil in April and ovipositing on the young shoots. Both the adults and larvae, which appear in May, feed on the leaves. After about 15 days, the larvae pupate in the soil, and the young adults emerge a fortnight later, but after remaining on the surface a short time enter hibernation

without laying any eggs. Severe infestation of lucerne by *Phytodecta fornicata*, Brüggm., was recorded from many localities. The date at which the hibernating beetles emerge from the soil varies in different localities, occurring between the end of March and the middle of June. Eggs are laid in batches or strings on the lower surface of the leaves and hatch in 6 days. Under favourable conditions the larval stage lasts 16–18 days, and the pupal 25, pupation occurring in the soil. The adults remain on the surface for the remainder of the summer, but do not oviposit till the following spring. Owing to protracted emergence from hibernation and oviposition, all the stages may be found simultaneously. Control measures include repeated mowing of lucerne, with subsequent rolling, spraying with arsenicals and letting poultry run in infested fields to feed on the larvae. *Entomoscelis adonidis*, Pall. [*R.A.E.*, A, xvii, 594] was recorded in 1929 from many parts of the country where no rape was cultivated, breeding on wild crucifers. In autumn the adults migrated in large numbers to rape fields, sometimes situated large distances away. *Rhagoletis cerasi*, L., was very common on sweet cherries, and in many instances damaged 80–100 per cent. of the fruit. The adults emerged from overwintered pupae early in spring. Only one egg is laid in each fruit. The egg stage lasted about 3 days and the larval stage 15. The measures recommended are spraying with lead arsenate during the period of the emergence of the adults, digging the soil under the trees to kill the pupae, and collecting the larvae.

[Dryenski (P.).] **Дрѣнски (П.). Ueber die Biologie des** *Loxostege* (*Phlyctaenodes*) *sticticalis* **L. in Bulgarien.** [On the Biology of *L. sticticalis* in Bulgaria and its Control (*in Bulgarian*).]—*Mitt. bulgar. ent. Ges.*, v, pp. 39–62, 3 figs., 17 refs. Sofia, 1930. (With a Summary in German.)

Loxostege sticticalis, L., caused very severe damage to a variety of crops in all parts of Bulgaria in 1929. Other serious outbreaks of the moth in that country are briefly reviewed from the literature, and the adults, larvae, pupae and cocoons, which are made in the soil, are briefly described. Three generations occur annually in Bulgaria, the larvae hatching in the beginning of June, in mid-August, and about the middle of September. The third generation larvae enter the soil for hibernation from about the middle of October and pupate in the following May. Some of the larvae of the second generation did not pupate in 1929, but spent the winter in their cocoons. The eggs are laid in small batches on the leaves of a wide range of wild and cultivated plants, a female depositing about 150 in all. In one locality in southern Bulgaria, the females of the second generation did not pair or oviposit, and although the adults were very abundant, no third generation was produced; similar cases are discussed from the literature [*cf. R.A.E.*, A, iii, 233]. The life-cycle of the moth covers a period of 30–35 days, the larval stage lasting three weeks. The larvae skeletonised the leaves of beet, cotton, tobacco, hemp and various vegetables, and in northern Bulgaria (Plevna) they attacked grapes, decreasing the crop by 30 per cent. They also fed on the leaves of all deciduous trees, except oak. Laboratory observations showed that they die in 3–4 days if deprived of food, and that cannibalism is common. Mass migrations of the larvae, which frequently

cover an area of several miles, are briefly discussed ; no satisfactory explanation of this phenomenon has been given. The adults are strongly attracted by light.

Swallows destroy the adult moths, and poultry and other birds feed on the larvae. In October 1929, 15–20 per cent. of the larvae were killed by parasites and 35–40 per cent. died from unknown causes ; two unidentified Ichneumonids and one Tachinid were reared from them in the laboratory.

Measures suggested for the control of *L. sticticalis* include the use of insecticides, of which the best is a 4–5 per cent. solution of barium chloride, which is both a stomach and contact poison. Although repeated spraying with 1 lb. Paris green in 50 gals. of water gives good results, it should not be applied to plants the leaves of which are used for food. If neither of these materials is available, a spray recommended by Mokrzecki may be used. It consists of 5 lb. tobacco boiled for 1–2 hours in 6 gals. water, to which $2\frac{1}{2}$ lb. soap is added after straining. The spray should be applied when it cools down to 75° C. [167° F.], at which temperature it does not damage the plants but kills the larvae.

[CHIPISHEV (V.).] **Чйпишев (В.).** (TSCHIPISCHEV, W.). **Der Wiesenzünsler** (*Phlyctaenodes sticticalis*) **in Bulgarien während des Jahres 1929.** [The Meadow Moth (*Phlyctaenodes sticticalis*) in our Country in the Year 1929 (*in Bulgarian*).]—*Mitt. bulgar. ent. Ges.*, v, pp. 203–206. Sofia, 1930.

This is a brief account of the outbreak of *Loxostege* (*Phlyctaenodes*) *sticticalis*, L., discussed in the preceding paper. It began in eastern Bulgaria, but rapidly spread all over the country. The percentage of parasitism was very low : *Tachina* (*Eutachina*) *erucarum*, Rond., *Eulimneria* (*Limnerium*) *geniculata*, Grav., and nine unidentified parasites were reared from the larvae in the laboratory.

Insect Pests and Plant Diseases.—*Rep. Conf. Emp. Meteorol., 1929*, Agric. Sect., pp. 11–12. London, H.M. Stationery Office, 1929. Price, 1*s*. net.

The following is an extract from this report : The Conference emphasise the value to practical agriculturists of forecasts of seasonal appearance of insect pests and plant diseases and their mass outbreaks, and recommend that research directed to the discovery of the relations between the various meteorological factors and insect activities and plant diseases should be energetically pursued with a view to providing bases for such forecasts. The Conference note that entomologists and mycologists are investigating methods for determining and describing the intensity of attack of insect and fungous pests on crops, and express the hope that it will be possible for standard methods to be established. Investigations should be carried out on the following subjects : The application of the climograph method to studies in the distribution, seasonal cycle of development, and periodic fluctuations in the numbers of insects ; the effect of atmospheric motion on the distribution of insects ; the insect fauna of the upper atmosphere ; the influence of coloration of insects on their thermal economy ; the effects of atmospheric pressure on insect activities and development ; the part

played by light in the development of insects. The development of work along these several lines is dependent upon the co-operation of research meteorologists with entomologists, capable of dealing with the physiology of insects.

UVAROV (B. P.). **Weather and Climate in their Relation to Insects.**—*Pap. Conf. Emp. Meteorol., 1929,* Agric. Sect., pp. 130–147, 40 refs. London, H.M. Stationery Office, 1929. Price, 1*s.* net.

A brief review is presented of the main literature dealing with the influence of temperature, humidity, precipitation, wind, atmospheric pressure, light and combinations of these factors on insect activities and development. The effects of climatic factors on the geographical and ecological distribution, and on the seasonal cycles and periodicity of mass appearance of insects are discussed. The main problems for further investigation are outlined, and the need for a close co-operation between entomologists and meteorologists is stressed.

DE GRYSE (J. J.). **The Relations of Entomology to Meteorology.**—*Pap. Conf. Emp. Meteorol., 1929,* Agric. Sect., pp. 148–167. London, H.M. Stationery Office, 1929. Price, 1*s.* net.

This outline of observations made in Canada shows the great importance of meteorological phenomena in the study of insects. Since experiments have proved that a variation of 4 or 5 degrees Fahrenheit may definitely affect the rate of development and behaviour of insects, the preparation of accurate climographs and hythergraphs [*R.A.E.*, A, xvii, 282] and the collection of exact data on meteorological factors are of great advantage, and the more general use of recording instruments and of a continuous series of meteorological data, as well as closer co-operation between biologists and meteorologists, cannot be too strongly advocated.

THEOBALD (F. V.). **Notes on Insects feeding on Hops in 1928 and 1929.**—*Entomologist,* lxiii, no. 800, pp. 7–10, 1 fig. London, January 1930.

The following insects were observed on hops during 1928 and 1929, in addition to some of those recorded in the previous year [*R.A.E.*, A, xvi, 427]: *Tyria* (*Euchelia*) *jacobeae*, L. (cinnabar moth), apparently recorded for the first time on hops, the larvae feeding on the lower leaves and most of them being parasitised; *Monima* (*Taeniocampa*) *munda*, Schiff. (twin spot quaker), the larvae of which gnawed the bine, thus checking growth; *M. incerta*, Hufn. (*T. instabilis*, Schiff.) (clouded drab moth); *Agrotis* (*Tryphaena*) *pronuba*, L. (large yellow underwing); *Vanessa io*, L., colonies of which rapidly strip the hills; the weevil, *Plinthus caliginosus*, F., the larvae of which tunnel in the roots; *Otiorrhynchus singularis*, L. (*picipes*, F.), which attacks the bines; *Agriotes sputator*, L., which ruins many hills, fifty wireworms sometimes being found in one; *Aphis rumicis*, L., which discolours the upper surface of the leaves in round patches; the Capsid, *Lygus spinolae*, Mey., which oviposits in the poles, in old woodwork or in the stubbs of the hops; *L. pabulinus*, L., found in one instance, having come from a badly attacked strawberry bed in the vicinity; and *Tetranychus telarius*, L., seen in 1929 only during hot, dry weather.

GREEN (E. E.). **Observations on British Coccidae, xii.**—*Ent. Mon. Mag.*, lxvi, no. 788, pp. 9–17, 4 figs. London, January 1930.

Notes are given on a number of species, including *Pseudococcus nipae*, Mask., which, since it was first observed in 1916, has become well established on palms in hothouses. The characters distinguishing *Lecanium corni*, Bch., and *L. coryli*, L. (*capreae*, L.) are defined, and a list of the names under which each has been recorded by Douglas, Newstead and the author is given. References by these authors to *L. persicae*, F., as a British insect are strictly referable to *L. corni*. The true *L. persicae* (*berberidis*, Schr.) is not indigenous in the British Isles, nor has it been recorded as introduced into greenhouses there. *L. corni* var. *crudum*, Green, has been observed on yew, this being apparently the first record of the infestation of a conifer by this species or any of its varieties. *Aspidiotus abietis*, Schr., was found on one consignment of seedling pines from the United States, male puparia only being observed ; this Coccid, though widely distributed in Europe and the United States, has not yet obtained a footing in the British Isles. Adult females of *Chionaspis pinifoliae*, Fitch, which does not occur in the British Isles, were found on the same pine needles. *Parlatoria pergandei*, Comst., was observed on branches of recently imported Japanese maple ; it has previously been imported on *Citrus* fruits, but it is doubtful whether it could survive a British winter in the open.

BROOKS (C. C.). **Recovery from Parasitism.**—*Nature*, cxxv, no. 3140, pp. 14–15, 3 refs. London, 4th January 1930.

Observations on *Rhyacionia* (*Evetria*) *buoliana*, Schiff. (pine shoot moth), which has recently been increasingly prevalent in numerous young pine plantations in eastern England, indicate that a slight check is exercised over its increase by various parasites that oviposit on the newly-hatched larvae. Larvae from areas in which the percentage of internal parasitism was high, when bred in the laboratory, yielded some fertile moths much smaller than the minimum accepted size for this species, whereas small moths were extremely rare among others coming from areas in which the percentage of parasitism was low. Larvae parasitised to the extent of 80 per cent. yielded 7 per cent. of moths with a wing span below the minimum, whereas others parasitised to the extent of 70 per cent. only gave about 2 per cent. of the small type ; and with less than 60 per cent. parasitism only 2 small moths were bred as compared with over 400 of the normal type.

Recovery from parasitism by phagocytosis of the parasites' eggs and newly-hatched larvae, as described by Timberlake and observed in young larvae of *R. buoliana*, appears to have no effect on the ultimate size of the adult, so that in the present case recovery probably takes place at a later stage in the life-history. Tothill has pointed out that the active histolysis that takes place in the pupal and pre-pupal stages of a moth renders them unsuitable for internal parasites that are devoid of some means of protection such as a trophamnion. It can therefore easily be imagined that a parasite larva, the development of which had been delayed until the host had reached the pre-pupal stage, would be attacked by phagocytes, broken down, and the tissues built up into the tissues of the adult moth. Such retardation of the parasite larva was often noted when super- or multiple parasitism

occurred and probably resulted either in the recovery of the host from parasitism, or death of host and parasites from mutual exhaustion. The development of the host larvae is only slightly retarded by the presence of internal parasites, but after the first instar the larvae are invariably found to be smaller both in general bulk and in the measurements of the head capsule than unparasitised ones of the same stage, so that it appears that recovery from parasitism occurs in the pupal or pre-pupal stage. The type of small pupae from which the small moths emerged showed a greater percentage of mortality than the normal type. No direct evidence has yet been obtained, but if the possibility of recovery from parasitism at a later stage in the life-cycle of the host can be established, it would elucidate many details of parasitic control of insects and account for the general incompleteness of the extermination of the host by this method. A parasitism of 100 per cent. would involve a large proportion of supernumerary parasites, which, by causing mutual retardation, would allow of a high percentage of recovery in the host. Thus the maximum mortality would be secured with a percentage of parasitism of less than 100, but this maximum will never be 100 per cent. in hosts in which such recovery occurs.

THOMPSON (W. R.). **Entomophagous Parasites and Phagocytes.**—*Nature*, cxxv, no. 3144, p. 167. London, 1st February 1930.

With reference to the hypothesis suggested in the preceding paper, the author states that his conclusions, based upon numerous dissections, agree with those of J. Pantel that as a general rule the healthy larvae of entomophagous insects are not surrounded by phagocytes, provided that they lie free within the body cavity of the host. If a parasite has an anatomical relation with the host of such a nature that destruction of the tissue is produced, a considerable accumulation of phagocytes may occur round the point of lesion. The extent to which phagocytes accumulate is variable and appears to depend in part upon the specific nature of the host and in part upon its general condition, but such an accumulation appears to have no effect on healthy parasites.

HUTCHINSON (H. P.) & KEARNS (H. G. H.). **Insect Pests of Willows.**—*Nature*, cxxv, nos. 3145 & 3147, pp. 201 & 276. London, February 1930.

The possibilities of extending the willow-growing industry in Britain are briefly discussed, and a short account is given of the principal insect pests of willow, which is attacked annually with varying severity, the loss frequently amounting to 50 per cent. or more of the crop. Injury is caused by *Phyllodecta* spp. and *Galerucella lineola*, F., in two ways, the first and most serious being an attack directed against the growing terminal buds, which causes the development of side shoots and ruins the rods, and the second an adult and larval attack on the foliage, resulting in impaired vitality of the plant and reduction of yield and quality. *G. lineola* appears to be confined to *Salix triandra*, whereas *Phyllodecta vitellinae*, L., attacks many species of willow, but never *S. triandra*. *P. vulgatissima*, L., seems only to occur on *S. viminalis*. *Pontania proxima*, Lep. (*gallicola*, Steph.), which commonly infests

S. triandra, *S. fragilis* and *S. alba*, producing galls on the leaves by oviposition, is not considered by growers to be a serious pest, but the gall formation when many leaves are attacked may cause a drain on the plant and probably results in reduced yields in the year of attack and lowers the vitality of the plant in the following season. This sawfly hibernates as a full-grown larva in a cocoon under loose bark, etc., and pupates in the spring, the adult emerging in May and ovipositing in the terminal unfolding leaves of the willow. The gall develops quickly and forms food for the larva within it, which reaches maturity about the third week in June, cuts an exit hole and pupates in a crack in the bark of the willow stump. A second brood of adults appears at the end of July, and the galls produced by the oviposition of this brood, which is greatly facilitated by still, sunny weather, cause the chief damage to the plant. In mid-September most of the larvae are full-grown and go into hibernation. The second brood of *P. proxima* is frequently attacked by Hymenopterous parasites, nearly every larva in some seasons being parasitised.

Mumford (E. P.) & Hey (D. H.). **The Water Balance of Plants as a Factor in their Resistance to Insect Pests.**—*Nature*, cxxv, no. 3150, pp. 411–412. London, 15th March 1930.

Reference is made to the observations of various authors which show that a disturbed water content of the soil renders plants more susceptible to the attack of certain thrips and other sap-feeding insects [*cf. R.A.E.*, A, xiv, 461, 619, etc.]. In addition to water-shortage in the tissues of the plant, the nitrogen content of the sap is also an important factor with regard to susceptibility to attack, a highly nitrogenous diet apparently stimulating reproduction of the insect.

Lundblad (O.). **Morotbladloppan** *Trioza viridula* **Zett. dess Biologi och Uppträdande som Skadedjur i Sverige.** [The Carrot Psyllid, *Trioza viridula*, Zett., its Biology and Distribution in Sweden.]—*Medd. CentAnst. Försöksv. Jordbr.* no. 350 (Lantbruksent. avd. no. 55), 45 pp., 19 figs., 21 refs. Stockholm, 1929. (With Summary in English.)

Trioza viridula, Zett., which causes leaf-curl in carrots throughout Sweden, has recently been particularly injurious in the southern part of the country, where the cultivation of carrots has been rendered impossible in some districts. All stages of this Psyllid are described in detail. The eggs of *T. nigricornis*, Först., which has only been recorded on carrots in the adult stage, were discovered for the first time on *Brassica*, which is possibly the true food-plant. They were attached to the leaves by fine stalks. Nothing has hitherto been known of the life-history of this Psyllid beyond the fact that it overwinters as a fully matured adult. Uniformly good results were secured in the control of *T. viridula* from 1923 to 1928 with nicotine sprays, but the cost is high, and cheaper materials, such as quassia, have been found almost as satisfactory. The first spray should be applied as soon as the first symptoms of leaf-curl appear, and the second a week later.

Augu Aizsardzibas Instituta darbibas pārskats par laiku no 1. maija 1928.g. lidz 1. maijam 1929.g. [Report of the Latvian Institute of Plant Protection for 1928–29.]—8vo, 12 pp., 4 figs. Riga, Latvijas Lauksaimniecibas Centralbiedriba, 1929.

This report contains sections dealing with insect pests observed in Latvia during the year ended May 1929. *Phyllotreta nemorum*, L., *Plutella maculipennis*, Curt., *Trioza viridula*, Zett., *Psila rosae*, F., *Aphthona euphorbiae*, Schr., and *Chlorops taeniopus*, Mg., were among the principal pests of cultivated plants in 1928, recorded by E. Ozols and J. Zirnits. The latter author discusses experiments with various sprays on Aphids. Ten per cent. carbolineum killed all the eggs of *Aphis pomi*, DeG. A 1 per cent. solution of soft soap proved effective against *A. rumicis*, L., *Cavariella* (*Siphocoryne*) *capreae*, F., and *Amphorophora* (*Rhopalosiphum*) *viciae*, Kalt., the toxicity of the spray being little increased by the addition of methylated spirit up to 10 per cent. The results of experiments on the effect of kerosene emulsion sprays at different concentrations on various plants are given. L. Bramanis records investigations on the injury caused by *Hylobius abietis*, L. Up to 50 per cent. of pines 3 or 4 years old were attacked by this weevil, and the average annual increase in height of badly damaged trees in 1926 and 1927 was 2 ins., as compared with 6 and 9 ins. respectively in healthy ones. The same author states that in certain coastal districts 50–55 per cent. of the farm buildings were infested by *Hylotrupes bajulus*, L., wood with broad annual rings being preferred. E. Ozols points out that owing to abnormal rainfall during the period of growth of peas there was no marked decrease in the injury to late crops by *Cydia* (*Laspeyresia*) sp. In experiments against *Phaedon cochleariae*, F., reliable results were only obtained by dusting with calcium arsenate. Observations by the same author on the percentage of injury to different varieties of barley by *Chlorops taeniopus*, Mg., showed this to vary from 9·2 to 55·5. On the whole the earlier crops suffered less, a difference of ten days in the sowing time resulting in a difference in injury of 10 per cent.

Chabrolin (C.). **Notes et observations relative aux dépérissements de l'abricotier. Les facteurs secondaires des dépérissements. Insectes.**—*Ann. Epiphyties*, xiv (1928), no. 5, pp. 365–366, 3 refs. Paris, September 1929.

Apricots are commonly attacked in the Rhône Valley by *Scolytus rugulosus*, Ratz., which is attracted to trees showing any sign of weakness. The larvae invade the cambium of the trunk and branches of dying trees and often kill temporarily weakened ones that would otherwise recover. *Xyleborus dispar*, F., and *X. xylographus*, Say (*saxeseni*, Ratz.) are equally common and destructive, the latter being almost invariably associated with decay, but only as a secondary factor. Larvae of *Cerambyx scopolii*, Füssl., are also found between the bark and the dead wood of decaying trees at the point of junction of the dead and healthy tissue, and appear to extend existing lesions. These insects constitute a menace to all weakly trees and should be destroyed by the removal of decayed trees or branches at appropriate periods.

Rapport phytopathologique pour l'année 1928.—*Ann. Epiphyties*, xiv (1928), no. 6, pp. 415–470, refs. Paris, 30th October 1929.

This report includes records of insect pests occurring in various parts of France during 1928 and accounts of the control measures employed against them, most of the information given having already been noticed from other sources.

Cereal pests included the wireworms, *Agriotes obscurus*, L., and *A. lineatus*, L., which particularly infested oats; *Cephus pygmaeus*, L., and *Contarinia tritici*, Kirby, which attacked wheat, fields in the neighbourhood of trees suffering most severely. Maize was infested by *Pyrausta nubilalis*, Hb., which also attacked *Sorghum*, and by *Sesamia vuteria*, Stoll (*nonagrioides*, Lef.). The root Aphids, *Anoecia corni*, F., *Tetraneura ulmifoliae*, Baker (*ulmi*, DeG.), and *Pentaphis* (*Forda*) *trivialis*, Pass., occurred on both wheat and maize. *Pegomyia hyoscyami*, Panz., was very injurious to beet, which was also attacked by *Lixus junci*, Boh., *Blitophaga* (*Silpha*) *opaca*, L., *Silpha obscura*, L., and *Euxoa* (*Agrotis*) *segetum*, Schiff. Hops were severely infested by *Tetranychus telarius*, L., and willow by *Phyllodecta vulgatissima*, L., *P. vitellinae*, L., and *Melasoma populi*, L. Flax plantations in the lower Seine were damaged by *Phytometra* (*Plusia*) *gamma*, L. *Hypopta caestrum*, Hb., and *Platyparea poeciloptera*, Schr., occurred on asparagus, and *Gortyna* (*Hydroecia*) *xanthenes*, Germ., on artichoke.

Pests of fruit included *Cossus cossus*, L. (*ligniperda*, F.) on peach; *Argyresthia ephippiella*, F., and *Aglaope infausta*, L., on cherry; *Hemerophila* (*Simaethis*) *nemorana*, Hb., on fig; *Incurvaria capitella*, Cl., on black-currant; *Anthonomus pomorum*, L., and *A. cinctus*, Redt., on apple; *Byturus tomentosus*, F., on raspberry; *Agrilus* (*Coraebus*) *sinuatus*, Ol., and *Anthonomus rubi*, Hbst., on strawberry; *Capnodis tenebrionis*, L., on peach, cherry, plum and apricot; *Ceratitis capitata*, Wied., on peach and pear; *Hyalopterus arundinis*, F. (*pruni*, F.) on peach; and *Hoplocampa fulvicornis*, Panz., on plum. The recent marked decrease in the numbers of *Polychrosis botrana*, Schiff., in many vineyards is attributed to the controlling effect of insect enemies, particularly *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.). *Sparganothis* (*Oenophthira*) *pilleriana*, Schiff., reappeared in large numbers in 1928. Other pests of vines included *Deilephila livornica*, Esp., *Exosoma* (*Malacosoma*) *lusitanicum*, L., *Vesperus strepens*, F., and *Reticulitermes lucifugus*, Rossi. Among forest trees, pines were attacked by *Dioryctria splendidella*, H.-S., and *Hylobius abietis*, L., and elms by *Galerucella luteola*, Müll.

Rapports sommaires sur les travaux dans les laboratoires en 1928.—*Ann. Epiphyties*, xiv (1928), no. 6, pp. 471–506, refs. Paris, 30th October 1929.

Individual reports are given of the work done in the laboratories of the entomological stations in France during 1928.

Berland (L.). **Les forficules sont-elles carnivores?**—*Bull. Soc. ent. Fr.*, 1929, no. 18, pp. 289–290. Paris, 1929.

Euborellia moesta, Géné, has been found in Provence for several years in succession in apples that had dropped to the ground and also contained larvae of *Cydia* (*Carpocapsa*) *pomonella*, L. Individuals in captivity, when offered pieces of fresh fruit and living larvae of *C.*

pomonella, sucked the fruit without consuming it, but rapidly devoured the larvae, and also a freshly killed fly that was given to them. Four of these earwigs kept in a petri jar, devoured one another until only one remained. These facts are borne out by observations of *Forficula auricularia,* L., which was recorded from Rouen as feeding on the larvae of *Gracilaria syringella,* F., and *Pieris brassicae,* L. [*R.A.E.*, A, xvi, 170]. There is no doubt that *Euborellia* entered the apples after they had fallen to the ground by way of the galleries bored by the larvae of *C. pomonella,* which are of a diameter just admitting of their passage. It would thus appear that earwigs may contribute to the control of injurious insect larvae, and it would be of interest to make further studies of the species mentioned and others, and to establish the proportion of their carnivorous diet and the degree and specificity of their prey.

Drastich (L.) & Rozsypal (J.). **Mšice Hrachová** (*Macrosiphum pisi* **Kalt.**) **a** *Entomophthora aphidis* **Hoffm.** [The Pea Aphid and *Entomophthora aphidis.*]—*Acta Soc. Sci. nat. Morav.*, iv, pp. 345–364, 11 figs. Brünn, 1928. (Abstract in *Rev. Appl. Mycol.*, viii, pt. 12, p. 779. Kew, Surrey, December 1929.)

During very severe outbreaks of *Macrosiphum pisi,* Kalt., on lucerne in South Moravia and Slovakia in 1926–27, the most effective control was achieved by the fungus, *Entomophthora aphidis,* the conidia of which are disseminated through contact with dead insects and also by wind.

Ionescu (E.). **Sur une déformation de** *Digitalis purpurea* **produite par des aphidiens.**—*C.R. Soc. Biol.*, cii, no. 35, pp. 967–968. Paris, 20th December 1929.

The author describes a characteristic deformation of the flowers of *Digitalis purpurea* caused by Aphids in Rumania.

[Vukasović (P.) & Kostić (D.).] **Вукасовић (П.) и Костић (Д.). The Control of** *Lecanium corni* **Bch. on Plums. Part ii.** [*In Serbian.*]—*Glasnik Tzentr. Khig. Zavoda,* iv (viii), no. 1–6, pp. 183–194, 4 figs., 2 tables, 1 ref. Belgrade, 1929. (With a Summary in French.)

In continuation of laboratory experiments against *Lecanium corni,* Bch., on plums [*R.A.E.*, A, xvii, 687], various sprays were tested in March and April 1929 near Belgrade in three orchards with varying degrees of infestation. A tar distillate (" carbocrimp "), at a concentration of 5–10 per cent., killed nearly all the Coccids, other materials, including oil emulsion and spray of nicotine and soap, being less effective. The cost of spraying with the different preparations is estimated, and the authors conclude that they are too expensive to be used in a general campaign. In some cases the infested branches were not reached by the spray, especially if the trees were tall and had a dense crown. Portable sprayers are of little use for various reasons, which are discussed, and should be replaced by a spraying apparatus of large output. Under present conditions in Serbia treatment in old plum orchards with large trees would not justify the expense involved ; but it should be carried out in well-cultivated and properly planted orchards with young and vigorous trees.

Nunberg (M.). **Przyczynek do biologji korników (Ipidae) i ogłodków (Scolytidae).** [Contribution to the Biology of Bark and Cambium Beetles.]—*Polsk. Pismo ent.*, viii (1929), pt. 1–4, pp. 91–122, 1 pl., 3 figs., 22 refs. Lemberg, 1930. (With a Summary in German.)

Notes are given on the biology of 37 species of Scolytids observed by the author in 1928 and 1929 in various parts of Poland. Observations indicated that *Scolytus mali*, Bechst., which attacks apples and pears, has only one generation a year; the young adults that appear in August are a parallel brood resulting from eggs laid by the same females that produced the first generation. *S. multistriatus*, Mrsh., known as a pest of elms only, though sometimes attacking plums and aspens also, was found infesting an ash tree, on which two females were captured near a mother gallery containing eggs. Several pairs of *Hylastes cunicularius*, Er., and *H. brunneus*, Er., were taken from a pine stump during oviposition, and on closer examination of the pairs, it was found that in several cases one beetle was *H. cunicularius* and the other *H. brunneus*; the author concludes, therefore, that the latter is probably only a race of the former. *Cryphalus intermedius*, Ferr., not previously observed in Poland, was found in July 1928 on *Larix polonica*. Laboratory observations showed that it has two generations a year. *Pityophthorus micrographus*, L., occurred in several localities in south-eastern Poland; its bionomics are similar to those of the allied *P. pityographus*, Ratz., from which it has been shown by Spesivtzev to be morphologically distinct, but the galleries are different, as they are chiefly made in the bark, and the larval tunnels are irregular and occur at various depths. *Ips* (*Pityogenes*) *bidentatus*, Hbst., which was found in pines, has two generations a year, the adults of the second appearing at the beginning of September; each generation has a parallel brood, and hibernation occurs in the larval, pupal and adult stages. *I.* (*Pityokteines*) *curvidens*, Germ., has only one generation a year; in 1928 about 25 per cent. of the galleries were infested with an unidentified fungus, which also attacked the larvae, in some cases killing all of them. *I. cembrae*, Heer, occurred in some localities on cut branches of larch about 1–3 ins. thick. The old adults died by the end of September, and the young ones were still immature at the end of October, completing their feeding in the galleries; examination of the latter indicated, however, that these beetles belonged to a parallel brood, and not to the real second generation, which appears in August.

Prüffer (J.). **Przyczynek do znajomosci biologji sówki pszenicznej (*Hadena basilinea* L.).** [Contribution to the Study of the Biology of the Wheat Moth (*Trachea basilinea*, F.).]—*Polsk. Pismo ent.*, viii (1929), pt. 1–4, pp. 135–140, 1 pl., 3 refs. Lemberg, 1930. (With a Summary in French.)

Although *Trachea* (*Hadena*) *basilinea*, F., is widely distributed in Poland, outbreaks seldom occur. A brief review is given of one that took place in the Government of Vilna in the autumn of 1928, when large numbers of larvae attacked the ears of rye. Short notes on the biology and control of the moth are taken from the literature, and the manner in which the larvae damage the ears is described; they appear to feed on the glumes and on both soft and dry grains.

Krasucki (A.). **Szkodniki owadzie na plantacjach buraków cukrowych w połud.-wsch. Polsce wa roku 1929.** [Records of Insect Pests of Sugar-beet in south-eastern Poland in the Year 1929.]—*Polsk. Pismo ent.*, viii (1929), pt. 1–4, pp. 207–210, 1 ref. Lemberg, 1930. (With a Summary in German.)

Brief notes are given on the seasonal occurrence and local distribution of the pests that attacked sugar-beet in south-eastern Poland in 1929, namely, *Phytometra* (*Plusia*) *gamma*, L., *Cassida nebulosa*, L., *Phyllopertha horticola*, L., *Pegomyia hyoscyami*, Panz. (*conformis*, Fall.), *Aphis rumicis*, L., and *Loxostege* (*Phlyctaenodes*) *sticticalis*, L. The adults of *L. sticticalis*, which caused particularly severe damage, appeared at the end of May and beginning of June. The larvae hatched about 10th June and infested a variety of crops, beet being completely destroyed in many places. In some plantations, however, where weeds were not removed, the young beet plants were not attacked, the larvae confining themselves exclusively to the weeds. Pupation occurred in early July at a depth of 2–3 ins. in the soil, and the resulting adults emerged about 20th July. Young larvae appeared at the beginning of August, but in small numbers only. The usual remedial measures are recommended, including cultivation of the ground during the pupal stage and destruction of the larvae by burning straw and removing the weeds. A method of catching the moths on sheets smeared with an adhesive is described. Several poles are fixed to the axle joining two wheels. The axle is about two feet from the ground, and the poles are inclined upwards and towards each other, so that at the other end they are about six feet from the ground. A strip of the sheet hangs down from the axle, the rest of it being stretched and fixed to the poles. The whole apparatus is pulled through the fields where the moths occur.

v. Szeliga-Mierzeyewski (W.). *Locusta migratoria* **L. und** *Stauroderus vagans* (**Eversm.**), **Zwei für die Wojewodschaft Wilno neue Geradflügler.** [*Locusta migratoria* and *Chorthippus vagans*, two Orthoptera new to the Government of Vilna.] [*In German.*]—*Polsk. Pismo ent.*, viii (1929), pt. 1–4, pp. 210–211. Lemberg, 1930.

On 26th November 1929 a male of *Locusta migratoria*, L. ph. *gregaria* (ph. *migratoria*) was found in a courtyard in Vilna itself. A small swarm of " large locusts " had been observed in late summer near the town.

Strawiński (K.). **Bielinek kapustnik**—*Pieris brassicae* **L.** (**Biologja oraz zwalczanie**). [The Cabbage Butterfly (Biology and Control).] —*Polsk. Pismo ent.*, viii (1929), pt. 1–4, pp. 227–248, 5 pls., 1 fig., 22 refs. Lemberg, 1930.

This is a detailed account of the biology of *Pieris brassicae*, L., in Poland, where it is a common and serious pest of cultivated crucifers, particularly cabbage. All stages are described. Two generations occur in the year, but the larvae of the first chiefly feed on weeds. The adults usually emerge from the overwintered pupae at the end of April or beginning of May. The butterflies are found till the end of September, as those of the overwintered generations are followed

in July by those of the summer one. The former deposit their eggs on the leaves of wild crucifers, and the latter on those of cabbage, always on the lower surface, in batches of 15–200, the maximum number laid by a female being 250. The oviposition period is protracted, and often eggs are still being laid when the larvae from the first batches are already mature. The larvae hatch in 8–12 days and feed gregariously. They cover the surface of cabbage leaves with a thin silken web, to which they cling. The larval and pupal stages of the first generation last 27–28 and 16–17 days respectively. The larvae of the second generation occur from the middle of July till the middle or end of September, and the larval stage lasts 13–17 days. The pupae of both generations are found adhering to tree trunks, walls, dry plants, etc.

Outbreaks are regulated by frequent epidemics of a fungous disease of the mature larvae caused by *Entomophthora sphaerosperma*, and by the parasite, *Apanteles glomeratus*, L., the adults, larvae and bionomics of which are briefly described. The parasitised caterpillars continue to feed and behave exactly as the healthy ones until they are about to pupate. Other parasites observed in Poland were *Pimpla brassicariae*, Poda, *Pteromalus puparum*, L., and a species of *Angitia*, which attacks the very young larvae, abandoning them when they are half grown. Insectivorous birds destroy the pupae.

The control measures recommended include collecting the larvae, for which gloves must be used as they have glands that produce an irritating fluid ; for the same reason poultry should not be allowed to feed on them. To facilitate the collection of the pupae, dry branches should be laid in the autumn among rows of cabbage to attract the larvae for pupation. Spraying with 1 lb. Paris green and 2–3 lb. lime in 100 gals. water did not scorch the cabbages and killed 50–80 per cent. of the larvae ; these were chiefly of the third and fourth instars, probably owing to the fact that they feed on the upper surface of the leaves. A proprietary dust containing 10 per cent. of Paris green was very effective and cheaper than the spray. Other methods of control are briefly reviewed from the literature, and it is suggested that experiments should be made with the sprays recommended by F. H. Chittenden against the larvae of *P. rapae* [*R.A.E.*, A, xiv, 408], and that ants' nests should be established in the cabbage fields, as the ants feed on the larvae, this measure having been found effective in Russia.

[SAKHAROV (N.).] **Сахаров (H.). Injurious Noctuids and their Control.** [*In Russian.*]—79 pp., 35 figs., 2 diagr., 1 map, 63 refs. Saratov, Akad. S.-Kh. Nauk Imeni Lenina, Inst. Bor'be Zasukh. [Lenin Acad. Agric., Inst. Combat. Drought.] 1930.

This is a somewhat popular account of the bionomics of *Euxoa tritici*, L., *Feltia exclamationis*, L., and *E. segetum*, Schiff., in the Lower Volga region, the life-history, economic importance, parasites and control of the last-named being dealt with in particular detail. Much of the information is compiled from the literature but some observations by the author are included. Parasites reared by him were : *Amblyteles negatorius*, F., *A. vadatorius*, Ill., *Ophion luteus*, L., and *Phryxe vulgaris*, Fall., from larvae of *E. segetum* ; *Amicroplus* (*Macrocentrus*) *collaris*, Spin., and *Tachina larvarum*, L., from those of *F. exclamationis* ; and *Cnephalia bucephala*, Mg., *Gonia capitata*, DeG., and *G. ornata*, Mg., from pupae of both species.

[BURAKOVA (L.).] **Буракова (Л.). Quantitative Analyse der Fauna von** *Brassica oleracea* **zu Peterhof.** [The quantitative Analysis of the Over-ground Fauna. The Population of Cabbage (*in Russian*).]—*Trav. Soc. Nat. Leningrad*, lix, no. 1, pp. 83–94, 3 diagr., 9 refs. Leningrad, 1929. (With a Summary in German.)

This is an account of a study of the fauna of cabbage, excluding soil fauna, carried out near Leningrad in July–August 1924 and July–September 1925, the results being given in tables. The technique is described, and diagrams indicate the relative percentage in each year of the various orders of insects that constituted the fauna of the plants.

In the course of the observations, it was found that the larvae and adults of *Rhacognathus punctatus*, L., were predacious on the larvae of *Phaedon cochleariae*, F., each of these Pentatomids destroying 60–90 during its life. The larvae of *Chrysopa perla*, L., fed on those of *Pieris brassicae*, L., killing 10–11 a day.

[VASIL'EVSKIĬ (N. I.).] **Васильевский (Н. И.). Die rose Muscardine und ihre Erreger** *Spicaria aphodii* **Vuill. und** *S. fumosorosea* **(Wize).** [The pink Muscardine and its causal Agents, *S. aphodii* and *S. fumosorosea* (*in Russian*).]—*Morbi Plantarum*, xviii, no. 3, pp. 113–148, 9 figs., 21 refs. Leningrad, 1929. (With a Summary in German.)

This is an account of laboratory observations carried out in 1925 near Leningrad on *Spicaria aphodii* and *S.* (*Isaria*) *fumosorosea* infesting the puparia of *Phorbia* (*Hylemyia*) *floralis*, Fall., and *P.* (*H.*) *brassicae*, Bch. The classification, culture characters and identification of these fungi are discussed ; *S. fumosorosea* was originally described as infesting the larvae of *Bothynoderes* (*Cleonus*) *punctiventris*, Germ., in the Ukraine.

Experiments on the infection of different stages of *P. floralis* and mature larvae of *P. brassicae* about to pupate by dusting with the spores of the fungi or burying the insects in infested soil are described in detail. Most of them were made with *S. fumosorosea*. Application of the spores to the eggs had practically no effect ; in one test only 4·7 per cent. of them were killed. The pupae remained immune in infested soil ; by direct contact with the spores, the rate of infection was inversely proportionate to the age of the pupae, being over 89 per cent. in those not older than one day and only about 6 per cent. in over-wintered individuals. Feeding the adults on infected syrup or placing them in a glass box, the bottom of which was covered with spores, resulted in the premature death of the flies. The larvae of all stages remained immune up to the short period preceding pupation ; dusting the larvae with spores when they were about to pupate, resulted in 75–100 per cent. mortality of the pupae, while burying them in infested soil killed 50–97 per cent. The development of the fungus in the puparium is described in detail.

From these experiments the author concludes that both *S. aphodii* and *S. fumosorosea* are pathogenic to *Phorbia* spp. The introduction into the soil of a sufficient number of spores of *S. fumosorosea* has the same effect on the larvae about to pupate as dusting them. The degree of humidity of the soil affects the mortality of the pupae ;

90–100 per cent. of them were killed by the fungus in soil containing 15 per cent. moisture, whereas only 13–75 per cent. were destroyed in soil with 100 per cent. humidity, though the rest were killed by a bacterial disease. Excessive moisture retards pupation and compels the larvae to migrate in the soil in search of drier places, in which process the spores are rubbed off their bodies. Temperature has a great effect on the development of infection, the percentage of infected individuals being in inverse proportion to the duration of their exposure to low temperature; only 20 per cent. of the pupae were infected when kept for 155 days at a temperature of from 4 to —6° C. [39·2–21° F.], as compared to 75 per cent. after an exposure of 18 days. Field experiments in infecting the larvae of *P. floralis* and *P. brassicae* with *S. fumosorosea* are described; at the end of July larvae in rape or swedes were buried in a plot into which a culture of the fungus had been introduced, and in September the puparia were removed to the laboratory and placed in sterile soil. Only 5 per cent. of them produced adults, 34 per cent. being killed by the fungus, and the remainder dying from other causes.

Attempts to infest larvae of *Musca domestica*, L., about to pupate by adding spores of *S. fumosorosea* to the organic matter in which they were bred, resulted in the death of only a small percentage of the pupa. Experiments in infecting larvae of *Melolontha melolontha*, L., were unsuccessful.

Tests in the infection of the mature larvae and adults of *P. floralis* with the spores of *S. farinosa, Beauveria densa* and a species of the group *B. bassiana,* indicated that these fungi infest the adult stage only.

Various opinions on the practical value of fungi for the control of insect pests are briefly reviewed, and the author suggests that the method of disseminating them in the soil may prove of economic importance.

[SHCHEPKINA (T. V.).] **Щепкина (Т. В.). Der Einfluss der Fritfliege** *Oscinosoma frit* **L. auf das Wachstum und die Entwicklung der Gerste.** [The Influence of the Frit-fly, *Oscinella frit,* on the Growth and Development of Barley (*in Russian*).]—*Morbi Plantarum,* xviii, no. 3, pp. 148–168, 3 figs., 2 diagr., 12 refs. Leningrad, 1929. (With a Summary in German.)

The investigations exhaustively discussed in this paper were carried out near Leningrad from 1924 to 1927, barley in different stages of development being artificially infested with *Oscinella* (*Oscinosoma*) *frit,* L. The results indicate that this fly is an important pest of barley in the early period of its growth only. Injury to the main stem when it has two leaves only is fatal, and if it is attacked before it has developed four leaves and before tillering has begun, the latter and the ripening of the grain are retarded, and a 30–40 per cent. loss of the ultimate crop results. Infestation of the side-shoots of more mature or full-grown plants and of the ears has, on the contrary, a favourable effect on the ultimate yield, as heavier and larger grains are produced, the plants being considerably taller. As untreated control plants, and those from which different stems were mechanically removed, did not similarly increase in length, even in well manured soil, and the crop produced was half that yielded by the infested plants, the author concludes that

the presence of the larvae stimulates the growth of the infested plants and results in a better crop. In the first stage of infestation the growth of the stem next to the infested one is retarded, owing to the upsetting of the metabolic processes, but in the second stage the stem begins to grow rapidly and new shoots are produced. The intensity of tillering largely depends on the age and vigour of the infested plant, the time of sowing, meteorological conditions, manuring, etc. In order to determine whether the stimulating power rests in the pest itself or is a result of its activity, plants were given injections of distilled water alone, emulsions of crushed larvae or pupae, or an extract from infested plants with profuse tillering. Favourable results were obtained in the latter case only, the treated plants producing new side-shoots. The other injections had no effect.

As early infestation is detrimental to barley, it is essential to determine the time of sowing in relation to the mass appearance of the flies, so that only the side-shoots, which appear later, are attacked. Observations indicated that the flies prefer young stems to the more mature ones ; barley of an inferior quality should therefore be repeatedly sown at the edges of fields in order to attract them and protect the more valuable crop from a too early infestation.

[Golovyanko (Z. S.).] **Головянко (З.С.). Experiments on the Use of Paradichlorobenzene for the Control of the Larvae of the Field Cockchafer** (*Melolontha melolontha* **L.**). [*In Russian.*]—*Sbor. Sortovo-Semenn. Upravl.*, 1928, no. 5 (13), pp. 115–136. Kiev, 1928.

Following experiments against *Polyphylla fullo*, L. [*R.A.E.*, A, xvi, 293], paradichlorobenzene was applied in June 1927 against larvae of *Melolontha melolontha*, L., which severely infested plantations of sugar-beet in western Ukraine, to test the value of the fumigant in heavy soil. Most of the larvae occurred in the upper layers to a depth of about 8 ins., and the eggs at a depth of 8–12 ins. Larvae of *Amphimallus solstitialis*, L., and other Lamellicorns were comparatively scarce. Paradichlorobenzene was applied in the same manner as in the Lower Dnieper Sands [*loc. cit.*] ; the technique of the work is described. When the fumigant was placed in holes 7 ins. apart, 1 gm. to each hole killed 96·4 per cent. of the larvae of *Melolontha* and all those of other Lamellicorns, and 3 gm. destroyed all the larvae of *M. melolontha* as well. Only a few of the eggs were killed and wireworms were not affected. When a larger distance was left between the holes, the fumigant was considerably less effective, although applied at high dosages, so that it would be very much more expensive to use in a heavy soil than in sands. The author, considers, however, that further experiments might give more favourable results.

Heymons (R.), Lengerken (H. v.) & Bayer (M.). **Studien über die Lebenserscheinungen der Silphini (Coleopt.). V.** *Silpha tyrolensis* **Laich.** [Studies on the Bionomics of Silphini. V.]—*Z. Morph. Oekol. Tiere*, xvii, no. 1–2, pp. 262–274, 4 figs., 23 refs. Berlin, 20th February 1930.

A detailed account is given of *Silpha tyrolensis*, Laich., which resembles *S. obscura*, L. [*R.A.E.*, A, xvi, 58] in its diet and many of its habits, but is not of economic importance.

Janisch (E.). **Experimentelle Untersuchungen über die Wirkung der Umweltfaktoren auf Insekten. 1. Die Massenvermehrung der Baumwolleule** *Prodenia littoralis* **in Aegypten.** [Experimental Investigations on the Effects of environmental Factors on Insects. 1. The Outbreaks of *P. litura* in Egypt.]—*Z. Morph. Oekol. Tiere*, xvii, no. 1–2, pp. 339–416, 14 figs., 2 pp. refs. Berlin, 20th February 1930.

The outbreaks of *Prodenia litura*, F. (*littoralis*, Boisd.) on lucerne and cotton in Lower Egypt begin each year in early spring, and after several generations, the moth reaches its maximum numbers about the end of June and beginning of July. Between the end of July and early August, its numbers decrease very rapidly, although there is no increase in the percentage of parasitism. The beginning and end of the outbreak are determined entirely by temperature, since humidity varies little throughout the season, owing to irrigation.

Experiments under laboratory conditions on the influence of constant and varying temperatures on the rate of development of the various stages proved that development is not in a direct proportion to time, but can be regarded as a regularly retarded movement. Formulae and graphs indicating the rate of development as affected by temperature are presented on the basis of this concept. From the formulae it is possible to calculate the effect of even short exposures to the temperatures differing from the optimum on the subsequent course of development, and thus to evaluate the influence of such fluctuations of the temperature as occur in nature.

The author discusses the concept of critical thermal points for development of insects and concludes that such points do not exist in the biological sense and that development can continue, though it may be much retarded, at any temperature that is not injurious to the organism. The extreme temperatures, which are injurious, are of particular importance, since they control outbreaks of insects and determine the length of stages in their development. Average temperatures are, therefore, of very little value, since they do not reflect departures from optimum conditions.

Humidity and nutrition have the same general biological influence as temperature in that a variation from the optimum increases the length of development. The optimum relative humidity for *Prodenia litura* was found to be 90–95 per cent.

Faure (Jacobus C.). **The South African Citrus Thrips and five other new Species of** *Scirtothrips* **Shull.**—*Bull. Transvaal Univ. Coll.*, no. 18, 18 pp., 3 pls. Pretoria, 20th December 1929.

The new species described are *Scirtothrips aurantii*, on a great variety of plants including *Citrus*, and other fruit trees, vines, beans and peas; *S. combreti*, on *Combretum* spp. and *Portulacaria afra*; *S. fulleri*, on *Citrus* and various wild plants; *S. africanus*, on peach, mulberry, etc.; *S. zuluensis*, on *Acacia*; and *S. spinosus*, on *Osyris abyssinica*. Keys to both sexes of the adults of these species are given as well as the characters distinguishing *S. aurantii* from the Californian *S. citri*, Moult., the Indian *S. dorsalis*, Hood, and the Australian *S. australiae*, Hood.

S. aurantii, which is probably responsible for practically all the damage by thrips to *Citrus* in South Africa, is the most common and

widely distributed species. The injury is caused by the larvae and adults feeding on the young fruit and on the foliage ; the blossoms are not attacked. Several other species of Thysanoptera are found on the flowers, but these do not injure the fruit or foliage. The nature of the damage to the surface of the fruit, which is sometimes serious, is described. Injury to the foliage in the case of nursery trees may almost completely destroy the young shoots as they appear, so that practically no growth results. *S. aurantii* is most abundant from October to January, during hot and dry weather ; adults, however, may be found on out-of-season, tender shoots and fruit at any time. It tends to become very scarce on *Citrus* after continued heavy rains. Spraying with lime-sulphur (35° Bé.), 1 : 80, preferably with the addition of a spreader, will to a large extent prevent injury, though the cost is not always justified. Three applications, at a pressure of 150–200 lb., should be made, the first when most of the petals have fallen, the second 10 days later, and the third 3 weeks after the second.

KORSCHEFSKY (R.). **Bemerkungen über afrikanische Epilachninen mit Beschreibung einer neuen Art. (Col.) (3. Beitrag zur Kenntnis der Coccinelliden).** [Notes on African EPILACHNINAE with a Description of a new Species. Third Contribution to the Knowledge of Coccinellids.]—*Deuts. ent. Z.*, 1929, pt. 2, pp. 141–143, 2 figs. Berlin, 15th July 1929.

The species dealt with include *Epilachna dahlbomi*, Muls., and *E. godarti*, Muls., recorded from Natal and on cotton in Portuguese East Africa.

Cultivation of American Cotton.—*Leafl. Dept. Agric. 'Iraq*, no. 15, 13 pp. Baghdad, 1927.

Earias insulana, Boisd. (spotted boll-worm) is the only serious pest of cotton in Iraq, the adults laying their eggs on the cotton plant and the larvae feeding on the bolls and buds. Hibernation takes place as a pupa or inactive larva. Control measures recommended include the uprooting and burning of all cotton plants not later than 31st December, and the ploughing, and where possible, the heavy irrigation of the land early in January ; keeping the new crop free from weeds ; and collection and burning or burying of all affected parts of the plants as soon as infestation is observed.

[GUPTA (S. R.).] [**Entomology.**]—*Rep. Dept. Agric. Assam 1928–29*, pp. 44–45. Shillong, 1929.

Hispa armigera, Ol., caused serious damage to rice in Assam in 1928–29. No method has yet been found of controlling this beetle in the extensive grassy areas in which it usually breeds. Other rice pests were *Cirphis* sp., *Nymphula depunctalis*, Gn., and the rice bug [*Leptocorisa varicornis*, L.]. Orange was attacked by *Papilio demoleus*, L., and *P. polytes*, L. ; *Phyllocnistis citrella*, Staint., which mines in the young leaves ; *Rhynchocoris humeralis*, Thunb., which sucks the young fruits, causing them to fall or become rough and dry ; *Monochamus* (*Monohammus*) *versteegi*, Rits., which bores through the stems ; a Lamiid borer attacking the young shoots ; mealybugs that infest the trunk just below the soil ; and Aphids, which were controlled by

kerosene emulsion. Other pests recorded include *Eriophyes* sp. on litchee; Aphids and mealybugs on guava; *Diacrisia obliqua*, Wlk., on jute; and *Dysdercus cingulatus*, F., *Sylepta derogata*, F., and Jassids on cotton.

MILLER (N. C. E.). *Physomerus grossipes* **F. (Coreidae. Hemiptera-Heteroptera). A Pest of Convolvulaceae and Leguminosae.**—*Malayan Agric. J.*, xvii, no. 11, pp. 403–418, 8 figs., 2 refs. Kuala Lumpur, November 1929.

The Coreid, *Physomerus grossipes*, F., all stages of which are described in detail, is abundant in Malaya, where it is found on convolvulaceous and leguminous plants, from the stems of which it sucks the juices. Plants thus attacked rapidly wilt and wither, and the fruits fail to develop or decompose before reaching maturity. The distribution of the bug is recorded; its food-plants include sweet potato and other species of *Ipomoea*, cowpeas (*Vigna catjang*), *Clitoria ternata*, and beans (*Phaseolus vulgaris*). The eggs are deposited in batches of up to 100 on the leaves or stems of the food-plants or on other plants in the vicinity. The female remains on or near the batch of ova for some days after the hatching of the nymphs, all of which crowd together on the food-plant. The incubation period lasts 17–21 days. The gregarious habit persists throughout life. The process of ecdysis is described. Post-embryonic development is gradual, the nymphal stage lasting about 60 days under laboratory conditions. The total life from the egg to the death of the adult lasts about 16 weeks. There is a great variation in the duration of the five nymphal instars. Only one parasite of *P. grossipes*, an undetermined Chalcid, has so far been recorded.

Control measures include collection and destruction of eggs and shaking the nymphs and adults from the food-plant into large tins containing water with a film of kerosene. Operations should be undertaken against the adults in the early morning when they are least active. Spraying with kerosene emulsion is also effective against the nymphs and adults, but is not recommended for plants used for human consumption.

OCFEMIA (G. O.). **Bunchy-top of Abaca or Manila Hemp. i. A Study of the Cause of the Disease and its Method of Transmission.**—*Amer. J. Botany*, xvii, no. 1, pp. 1–18, 4 pls., 17 refs. Lancaster, Pa., January 1930.

The Aphid, *Pentalonia nigronervosa*, Coq., the vector of bunchy-top of Manila hemp [*Musa textilis*] in the Philippines [*R.A.E.*, A, xv, 346, etc.], is not capable of prolonged flight, and is spread in the field chiefly by ants, the most common being *Plagiolepis longipes*, Jerd., and *Dolichoderus bituberculatus*, Mayr.

RISBEC (J.). **De l'importance énorme des céroplastes en Nouvelle-Calédonie.**—*Rev. agric.*, no. 122, pp. 1–2. Noumea, September 1929.

A species of *Ceroplastes* is present throughout New Caledonia and causes great damage, attacking a large variety of trees, and being

almost always associated with a sooty mould fungus. Although it does not usually cause the death of the tree, young oranges and tangerines are frequently killed. On such trees, an oil emulsion, applied after brushing them thoroughly, might be used, but the best remedy is to watch the trees and cut off and burn infested parts. Larger trees when infested continue to grow almost normally, but do not bear fruit ; this is particularly marked in the case of mango, orange and tangerine. The cajeput oil tree (*Melaleuca leucadendron*), though often infested, is resistant to the Coccid, and when attacked sends out new and larger leaves which largely compensate for the loss of growth to the rest of the foliage, but the manufacture of the essential oil must be greatly hampered by the presence of the sooty mould. The effect of this *Ceroplastes* on noxious plants is briefly discussed, but it is not considered likely to be of any value in controlling them. *Lantana* is not attacked.

ARAKAWA (Y.). **The Life-history of** *Galeruca banghaasi*, **Weise.** [*In Japanese.*]—*Insect Wld.*, xxxiv, pp. 74–79, 3 figs. Gifu, March 1930.

Galeruca banghaasi, Weise, all stages of which are described, is very injurious to *Allium odorum* in Manchuria. There is one generation a year, hibernation taking place in the egg stage. The larvae hatch in April and feed on the young buds, pupating towards the end of May near the base of various plants. The adults, which emerge a week later, are nocturnal, but do not feed to any extent, and from July onwards remain dormant in cracks in the soil or on the ground round the food-plant. They begin to mate and oviposit in the middle of September. The eggs are laid in masses of 70–200 in sheltered places or on the ground near the food-plant, the females dying soon after oviposition is completed.

ESAKI (T.). **Notulae cimicum japonicorum (1).**—*Kontyû*, iii, no. 2, pp. 71–75, 2 figs. Tokyo, July 1929.

The characters distinguishing *Lagynotomus assimulans*, Dist. (brown stink bug of rice) and *Aenaria lewisi*, Scott, have been confused by Matsumura, so that records by various Japanese authors of either species refer to the other [*cf. R.A.E.*, A, vii, 100 ; xv, 506 ; xvii, 344].

MIWA (Y.) & YANAGIHARA (M.). **The Effect of Elaterid Beetles on Sugar-cane Planting in Formosa.** [*In Japanese.*]—*J. Trop. Agric.*, i, no. 3, pp. 275–289, 1 pl., 1 ref. Taihoku, December 1929. (With a Summary in English.)

Nineteen species of Elaterids have been collected in sugar-cane fields in Formosa, some of which are not, however, of economic importance. *Melanotus tamsuyensis*, Bates, is most injurious, about 90 per cent. of the damage being done by it. It occurs all over the Island, laying its eggs singly in the soil from February until early summer. The larval stage lasts on an average over 5 years and the pupal stage about 24 days. *Agrypnus politus*, Cand., and *Lacon formosanus*, Bates, are carnivorous in the larval stage, feeding on

Lamellicorn larvae. The larvae of *Septilus formosanus*, Schwartz, feed on the young cane and also on Lamellicorn larvae, and those of *Heteroderes albicans*, Cand., on the larvae of various moth borers. *Cardiophorus formosanus*, Mats., is very common, but is not injurious. *Agonischius vittiger*, Heyd., is very injurious in the eastern part of the Island, and *A. obscuripes*, Gyll., is somewhat less so. Wireworms are most destructive in fields at the foot of mountains or on hills, which are mostly of light sandy soil and poorly irrigated. During the dry season they move deep into the ground, and are often found at a depth of 17 ins. when the soil surface is entirely dry. They cannot live for more than two weeks in dry soil, or survive in very wet soil, coming to the surface if the ground is completely saturated. The methods recommended for their control include complete irrigation of the field and thorough saturation with water for 4 or 5 days before planting ; selection of varieties of cane that grow quickly ; planting in the rainy season ; ploughing the fields and mixing compost, green manure or cane leaves with the soil ; deep ploughing to expose the wireworms on the surface ; and fumigation with carbon bisulphide or potassium cyanide.

SIMPSON (L. J.). **The Biology of the Canadian Bark-beetles. The Seasonal History of** *Dendroctonus simplex* **Lec.**—*Canad. Ent.*, lxi, no. 12, pp. 274–279. Orillia, Ont., December 1929.

An account is given of life-history studies carried out from 1925 to 1928 in New Brunswick on *Dendroctonus simplex*, Lec., which is abundant in dying larch throughout the larch areas of eastern Canada. In the spring of 1925 a healthy larch was felled and left exposed in the woods to obtain material for cage studies. The stump of this tree, which was found to contain the brood of one pair of *D. simplex*, was caged, and observations were made each week throughout the season. Under normal conditions of temperature and humidity, and with abundant room for boring in the bark, only one set of tunnels was cut. In 1926 all the beetles that developed from the tunnel of 1925 were employed, but sufficient wood was provided so that the tunnels were not crowded. Only a single egg tunnel was cut by each female, and it was concluded that *D. simplex* was single-brooded in New Brunswick [*cf. R.A.E.*, A, xvii, 623]. In 1927, however, when all the beetles developed in the previous year's experiment were employed and the same quantity of fresh wood provided, the parent beetles cut three sets of tunnels, although the season was unusually cold and wet. The first two broods had reached the adult stage by 1st August and 17th September respectively and hibernated in their original tunnels ; the third brood hibernated as larvae. Neither in this nor the preceding years did the parent beetles survive to hibernate. In 1928 an experiment was carried out to determine the influence of overcrowding on the number of broods. Young beetles, varying in numbers from 2 pairs to 80, were placed in each of five cages in which the same area of bark was provided. The locality was the same as before, and climatic conditions were normal. The parent beetles cut only one set of tunnels in all five cages. In two other cages supplied with larch of the same size, in which all the adults developed from the 1927 broods were employed and the bark was more closely crowded than in any of the other five, two broods developed during 1928.

Watson (J. R.). [**Report of the Department of] Entomology.**—*Rep. Florida Agric. Expt. Sta. 1927-28*, pp. 42R–49R. Gainesville, Fla. [1929.]

Aphis spiraecola, Patch (green citrus aphis) appeared in considerably smaller numbers than of recent years, owing probably to the winter being dry and cold, with consequent lack of young growth on *Citrus*. In order to multiply abundantly, the Aphids require not only young growth but also rapidly growing and succulent foliage. Young trees should therefore be set out early in the winter. Life-histories worked out simultaneously on *Citrus* and *Spiraea* showed that development and reproduction were more rapid on the former. During the spring migration the Aphids cover long distances, sometimes as much as 100 miles. Alternative food-plants are of minor importance, except in one area where satsuma oranges are grown and where wild crab-apple as well as *Spiraea* is heavily infested. The Aphids overwintered in the egg stage on the crab-apples, but the satsumas remained free from infestation, possibly because of a long dormant period and delay in new growth in spring. In other areas satsumas are severely attacked. Coccinellids and larvae of Syrphids were very effective in limiting the numbers of the Aphids. The indications are that it would be advantageous to grow near citrus groves during the winter such crops as turnips, rape, mustard and peas, which are particularly susceptible to Aphid attack ; the Aphids attacking these crops do not infest *Citrus*, but would attract predators which also feed on *A. spiraecola*. Efforts to establish the Chinese Coccinellid, *Leis* sp., do not seem to have been successful, owing apparently to ants, which drive away the adults and kill the larvae. Experience has shown that a thorough destruction of the few Aphid colonies surviving on *Citrus* in the winter is the cheapest and best method of control. A proprietary insecticide that is apparently a pyrethrum compound gave much better results than the usual 3 per cent. nicotine sulphate and lime dust ; as death was caused more quickly, the effect of the dust was less interfered with by wind.

Attempts were made to combine control for Florida flower thrips [*Frankliniella tritici bispinosa*, Morg.] and *A. spiraecola*, but the usual Aphid dusts do not penetrate the blossoms sufficiently, a driving spray being required for this. The thrips do not seem to be confined to the flowers but breed on any tender vegetation ; they have done serious damage to snap beans and to peanuts [*Arachis hypogaea*].

Fumigation with hydrocyanic acid gas under tents was very satisfactory against the Florida red scale [*Chrysomphalus ficus*, Ashm.] which is most difficult to kill with sprays ; for the pupae of whiteflies, a higher concentration of gas was necessary than for either the red or purple scale [*Lepidosaphes beckii*, Newm.]. Plant bugs, especially *Nezara viridula*, L., were troublesome in groves where *Crotalaria* was used as a cover crop, the bugs breeding in large numbers on beggarweed [*Meibomia*] and migrating to *Crotalaria* about October. As long as green pods remain on the latter, the bugs do not leave it to attack the fruits of *Citrus*. In some localities their parasites, especially the Tachinid, *Trichopoda pennipes*, F., control and sometimes exterminate them. After dry winter weather, red spiders were abundant on *Citrus* and, in some districts, on *Asparagus plumosus*. A commercial mixture of sulphur and an unknown oxidising agent gave much better results than sulphur as ordinarily used. On *Asparagus*, pyrethrum compounds and Derrisol spray gave better control than flowers of sulphur.

Lixophaga [*diatraeae*, Towns.] introduced against the sugar-cane borer [*Diatraea saccharalis*, F.] [*R.A.E.*, A, xvii, 84] has not been recovered in the field, although over a thousand have been liberated.

The pecan shuckworm [*Cydia caryana*, Fitch] was less injurious than in the previous year, and the adults emerged later. Spraying with arsenicals has proved valueless against the nut case-bearer [*Acrobasis caryae*, Grote] ; dormant sprays would seem to be the most promising remedy.

TAYLOR (R. L.). **The Biology of the White Pine Weevil,** *Pissodes strobi* **(Peck), and a Study of its Insect Parasites from an economic Viewpoint.**—*Ent. amer.*, N.S., ix, no. 4, pp. 167–246, 1 fldg. table ; x, no. 1, pp. 1–86, 10 pls., 11 pp. refs. Brooklyn, N.Y., 1929–30.

The first part of this paper is an account of studies, principally by other authors, on the bionomics and control of *Pissodes strobi*, Peck (white pine weevil), all stages of which are described [*cf.* *R.A.E.*, A, xiv, 581 ; xv, 406, etc.]. The second and larger part deals with the results of observations conducted in the eastern United States during 1926–29 on the biology of the parasites of this weevil, and includes a description of the breeding methods and technique employed and a short discussion of its predators and other factors influencing its natural control.

Of the eight primary parasites of *P. strobi* obtained, only *Eurytoma pissodis*, Gir., *Lonchaea corticis*, Taylor, and *Microbracon pini*, Mues., were sufficiently effective to be considered from the point of view of their artificial propagation as agents of control. These parasitised 6, 5½ and 2½ per cent. of the larvae respectively. The remaining parasites in order of importance are *Eupelmus pini*, Taylor, *Rhopalicus pulchripennis*, Cwfd., *Coeloides pissodis*, Ashm., *Calliephialtes nubilipennis*, Vier., and *Spathius* sp. Based upon emergence counts, parasites and predators accounted for about 19 per cent. of the mature weevil larvae in 3,009 leaders ; based upon dissection of these leaders, the maximum mortality ascribed to parasites and predators was about 27 per cent. It is concluded that in the present state of knowledge control of this weevil by its natural parasites would not be feasible, but it is possible that parasites attacking other species of *Pissodes* that occur in the western United States and in Europe might be of value if introduced. A list is given of those recorded from the European species.

THOMAS (C. A.), WORTHLEY (H. N.) & FROST (S. W.). **Department of Zoology and Entomology.**—*Bull. Pennsylvania Agric. Expt. Sta.*, no. 243 (42nd Ann. Rep. 1928–29), pp. 29–31, 1 fig. State College, Pa., July 1929.

In life-history studies of the summer brood of the codling moth [*Cydia pomonella*, L.], larvae were confined in different types of rearing cages on all sides of the trunks of apple trees and in boxes fastened to the branches. The records show that emergence is but little affected by the exposure of the transforming larvae ; the maximum emergence

of moths from all situations occurred between 3rd and 7th August. Chemically treated bands for killing pupating larvae were ineffective against transforming larvae of the spring generation, and not markedly effective against hibernating larvae, unless they remained in the bands all winter. The bands seemed to be too weakly impregnated with the chemicals to kill many larvae, but they were strong enough to check a disease that was epidemic and which killed 40 to 50 per cent. of the larvae in untreated bands and only 18 to 24 per cent. in the treated ones.

Sprays were found to control chewing insects on apple trees somewhat better than dusts, but neither had much effect on infestation by the plum curculio [*Conotrachelus nenuphar*, Hbst.]. During 1928, peach trees in which poison baits were hung showed more injury from the oriental fruit moth [*Cydia molesta*, Busck] when the crop was gathered than did the untreated trees, showing that the moths were attracted by the baits. Other insects visiting the baits are very briefly discussed.

In a study of wireworms as pests of vegetables, most of the repellents tried on the seeds prevented germination ; one pyrethrum compound, however, repelled *Pheletes agonus*, Say, and did not affect germination. A bran bait containing nitrobenzene was less attractive to the larvae of this wireworm than bran alone. Clover baits attracted adults of *Agriotes mancus*, Say, but not *P. agonus*. Ploughing in late July and August (which must be more than 8 ins. deep to be effective) killed many pupae in their cells, but had little effect on the larvae, unless birds were present.

Mushroom insects included a Noctuid larva that fed on the caps. An unidentified Hymenopterous parasite was reared from the Sciarid flies. Most of the insects and mites infesting mushroom manure came from the soil under and near the piles, and flies came from houses, old manure and discarded mushroom caps and stems ; manure piled on clean concrete flooring was quite free from mites and springtails. Burning sulphur in houses during the heating of the manure killed many flies, mites and springtails, which were driven to the surface by the heat. Great care is necessary with this treatment, or it may retard or kill the spawn subsequently placed in the manure.

The effectiveness of different kinds of plough with reference to infestation by the European corn borer [*Pyrausta nubilalis*, Hb.] is discussed ; no plough covered rubbish well enough to control the borer when working in standing stalks, either in autumn or spring.

BRIDWELL (J. C.). **A preliminary generic Arrangement of the Palm Bruchids and Allies (Coleoptera) with Descriptions of new Species.**— *Proc. Ent. Soc. Wash.*, xxxi, no. 8, pp. 141–160. Washington, D.C., November 1929.

In the course of this revision of the Bruchids that breed in the seeds of many American palms, the author erects a new genus, *Caryobruchus*, and gives a key to the group of species with the sides of the gula between the eyes parallel and not converging posteriorly. The new species described include *C. scheeleae*, *C. pararius*, *C. lipasmus* and *Pachymerus olearius* from the seeds of *Attalea speciosa*, *C. acrocomiae* from those of *Acrocomia*, and *C. pergandei* from those of *Astrocaryum*, all from South America.

FLINT (W. P.) & others. **Entomology Investigations.**—*Ann. Rep. Illinois Agric. Expt. Sta. 1928–29*, pp. 138–151, 2 figs., 1 ref. Urbana, Ill., 1929.

In 1928 the European corn borer [*Pyrausta nubilalis*, Hb.] spread to within 30 miles of the eastern border of Illinois. Data from experiments conducted in Ohio on the susceptibility of 39 varieties of maize to the attack of the borer are tabulated. Experiments against the grape colaspis [*Eucolaspis brunnea*, F.], which caused serious damage to maize following red clover [*R.A.E.*, A, xvi, 507], indicate that its numbers may be reduced by ploughing in red clover late in the autumn. Tests showed that maize seedlings grown from seed treated with various dips and dusts for controlling certain root and stalk diseases are in no way protected against attack by such pests as cutworms, wireworms and root Aphids. Information on dates of sowing wheat to avoid infestation by the Hessian fly [*Mayetiola destructor*, Say] has already been noticed [xvii, 284]. Further observations on the apple leafhopper [*Empoasca fabae*, Harr.] on red clover and lucerne [*cf.*, xv, 283, 458] and also soy-beans [*Glycine hispida*] indicate that certain varieties of the latter, especially those with smooth foliage, are also attacked. Lucerne should be cut as soon as injury begins to appear, and more resistant varieties of red clover and soy-beans should be grown.

Tests with certain oils, used alone or in combined sprays, against late broods of the codling moth [*Cydia pomonella*, L.] suggest that such oils are probably as effective as lead arsenate, but that they cannot be used throughout the year. Experiments with chemically treated bands against the larvae have already been noticed [xvii, 722]. The oriental peach moth [*Cydia molesta*, Busck], first discovered in Illinois during the winter of 1927–28, is now present in all the peach-growing districts in the southern part of the State.

A Staphylinid, *Baryodma verna*, Say, and a thread worm, *Hexamermis* sp., were reared from the onion maggot [*Hylemyia antiqua*, Mg.], parasitising 3 and 5 per cent. respectively. Tables showing the results of experiments against this pest in 1923 and 1924 are reproduced [xiii, 245], and brief reference is made to tests with proprietary oil emulsions in 1928. Severe damage to onions is often caused by the onion thrips [*Thrips tabaci*, Lind.]. The best results against it were obtained with a 2·4 per cent. nicotine dust applied with a hand duster and driven straight down into the plant.

Severe damage has been done for the past two years by the cyclamen mite [*Tarsonemus pallidus*, Banks]. It was observed that about $\frac{1}{6}$ oz. paradichlorobenzene (the size of a moth ball) placed in the cyclamen flats when the plants are first set out will almost completely rid even the most heavily infested ones of the mites ; so far no injury to the plants has resulted, whereas ordinary naphthalene moth balls used in a similar manner seemed slightly less effective and are likely to cause injury. Experiments against the greenhouse leaf tyer [*Phlyctaenia rubigalis*, Gn.], which attacks a number of plants in greenhouses, indicate that it may be controlled by dusting with lead arsenate and sulphur, 15 : 85. Trapping the adults by means of a white light of at least 200 watts set over shallow pans containing kerosene aided in control. The greenhouse centipede [*Scutigerella immaculata*, Newp.] has been causing increasing damage. In one instance a large crop of tomatos and cucumbers was entirely destroyed. The most satisfactory method of preventing damage consists of raising the benches supplied with new

soil and thus breaking contact with the subsoil. Though a small number of the Symphylids may occur in the raised benches, they are unable to breed in destructive numbers.

SAFRO (V. I.). **Community Shade Tree Spraying for Protection from the Japanese Beetle.**—*Circ. New Jersey Dept. Agric.*, no. 156, 33 pp., 16 figs. Trenton, N.J., February 1929.

Detailed instructions are given for the organisation of a campaign against *Popillia japonica*, Newm. (Japanese beetle) on shade trees. The necessary equipment for spraying with lead arsenate coated with lead oleate (at the rate of 8 lb. to 100 U.S. gals. water) is described, with particulars of costs for machinery, fuel, labour and spraying material.

VAN LEEUWEN (E. R.). **Control of the Japanese Beetle.**—*Circ. New Jersey Dept. Agric.*, no. 168, 8 pp., 1 fig. Trenton, N.J., June 1929.

As the result of investigations carried on for many years, recommendations are given for control of the Japanese beetle [*Popillia japonica*, Newm.] on various kinds of fruit and shade trees, shrubs and flowering plants [*cf. R.A.E.*, A, xiv, 156; etc.].

SKINNER (H. M.). **The Giant Moth Borer of Sugar-cane** (*Castnia licus*, **Drury**).—*Trop. Agriculture*, [vii, no. 1] Suppl., 8 pp., 1 pl., 2 figs., 4 refs. Trinidad, January 1930.

Castnia licus, Drury, which is confined to Trinidad, British Guiana and some other parts of South America, has greatly increased during the past two or three years in the southern part of Trinidad. From observations made subsequent to a serious infestation in 1927–28, when the losses to sugar-cane caused exceeded those due to *Diatraea* and froghopper [*Tomaspis saccharina*, Dist.], all stages of the insect are described and an account is given of its life-history. The eggs are laid singly, usually at the base of the cane in a concealed position between dry trash and the stem, about 45 being apparently the maximum for a female, though previous records from dissection indicate a maximum of 200. The larvae hatch in 7–14 days and begin to work their way down between the leaf sheath and the cane to ground level, where a small cavity is made on the surface of the cane. After remaining a few days in this position the larva tunnels into the heart of the cane, from which it does not emerge until the adult stage is reached. A vertical tunnel is made extending both upward and downward into the stock. The larval stage appears to occupy at least 8 weeks, but this period may be considerably protracted. The larvae are voracious feeders, tearing the cane, swallowing the juice and rejecting the fibre. Before entering the pupal stage, which seems to last 1–1½ months, the larva makes an exit hole in the side of the cane about 3–4 inches above ground level. The adult is unable to fly for about 3 hours after emergence, and many are probably destroyed by natural enemies during this time. The moths, most of which die without feeding, appear to live for several weeks.

C. licus attacks banana and coconut, which are introduced plants, as well as sugar-cane, but the original food-plant is not known, though the larvae have been found in the roots of *Canna*. A single larva can

destroy 1½–2 ft. of cane, apart from the boring done in the root stock, which weakens the stool and sometimes destroys it completely, always reducing its ratooning powers. The unbored portion sometimes dries up and either deteriorates or is entirely lost, and young shoots and suckers are converted into dead hearts. In badly attacked fields the loss often amounts to 25 per cent. of the crop. The degrees of attack and losses caused in several varieties of cane are shown in tables.

No parasites of *C. licus* were observed, and Elaterid larvae that were occasionally found attacking the larvae cannot be regarded as a controlling factor. Certain insectivorous birds, chiefly *Pitangus trinitatis* and *Holoquiscalus lugubris*, are the principal natural enemies. Bird reserves are gradually being established. Toads and lizards prey upon the moths, and ants probably destroy a considerable proportion of the eggs. A number of chemicals, including calcium cyanide, which was blown directly into the burrows, were tested as a means of killing the larvae remaining in the stool after the cane had been cut, but none gave satisfactory results. Numbers of adults were destroyed by gangs of workers with butterfly nets, but the most successful measure was the removal of larvae on a large scale, by means of special knives, from dead-heart suckers. Too much damage was caused to the grown cane by this method, however, and it was later confined to ratoon shoots or young plants. Over 1,600,000 larvae were destroyed from January to November 1928, and infestation was very greatly reduced in 1929. Records of catches from January 1928 to October 1929 indicate that the curve of adult numbers reached its apex in April. As the result of vigorous control, the curve fell during the next three months, but rose sharply again in July, August and September, indicating a second brood. From October the curve fell until April; there was another sharp rise in May and a subsequent drop in October, maximum infestation occurring in April, May and September. Numbers of larvae showed a steady upward tendency from March till August, when there was a rapid drop until December. Another rise occurred, which was maintained till May, and after a rapid fall in June there was another sharp rise in July and August and a subsequent fall in October, indicating the period of maximum infestation to be from June to August.

Cushman (R. A.). **Three new Ichneumonoid Parasites of the Rice Borer** (*Chilo simplex* (**Butler**)).—*Proc. Hawaii. Ent. Soc.*, vii, no. 2, pp. 243–245. Honolulu, December 1929.

New parasites described from *Chilo simplex*, Butl., are *Centeterus alternecoloratus* and *Angitia* (*Dioctes*) *chilonis* from Foochow, China, and *Chelonus chilonis* from Foochow and Japan. The author considers that *C. chilonis* is probably the species recorded by Kondo as *C. munakatae*, Mats., but has been unable to find descriptions of any of the four parasites ascribed by the latter to Matsumura [*R.A.E.*, A, vi, 236] and concludes that they are *nomina nuda.*

Illingworth (J. F.). *Engytatus geniculatus* **Reuter—an important Pest of Tomatoes in Hawaii (Hem.)**.—*Proc. Hawaii. Ent. Soc.*, vii, no. 2, pp. 247–248. Honolulu, December 1929.

In Hawaii, *Engytatus geniculatus*, Reut., injures tomatos by sucking the juice from the developing ovaries, causing premature fall of the

blossom and preventing the setting of the fruit. This Capsid occurs in the southern United States and Mexico, but is not known there as a pest. Together with a closely allied species, *E. notatus*, Dist., it is injurious to tobacco in Brazil [*R.A.E.*, A, xii, 65], though it has so far not been recorded on this crop in Hawaii. It should be easily controlled by means of miscible oil sprays, though under conditions of much rainfall several applications might have to be made.

ILLINGWORTH (J. F.). **Preliminary Notes of Pests of Agricultural Crops of Kona, March 15, 1928.**—*Proc. Hawaii. Ent. Soc.*, xii, no. 2, pp. 248–254. Honolulu, December 1929.

The following coffee pests in Kona are largely controlled by natural enemies : *Coccus viridis*, Green, by the Chalcids, *Aneristus ceroplastae*, How. (*Prococcophagus orientalis*, How.) and *Encyrtus* sp., and the Coccinellids, *Orcus chalybaeus*, Boisd., and *Chilocorus circumdatus*, Shön. ; *Pseudococcus brevipes*, Ckll., by the Coccinellids, *Rhizobius* (*Lindorus*) *ventralis*, Erichs., and *Cryptolaemus montrouzieri*, Muls.; *Ceratitis capitata*, Wied., by *Diachasma tryoni*, Cam. ; and *Toxoptera aurantii*, Boy., by the Syrphid, *Allograpta obliqua*, Say, *Chrysopa microphya*, McLach., and the Coccinellids, *Platyomus lividigaster*, Muls., and *Coelophora* (*Coccinella*) *inequalis*, F. Minor pests of coffee were the Tettigoniids, *Elimaea punctifera*, Wlk., and *Conocephalus saltator*, Sauss., and the Tineid, *Ereunetis simulans*, Butl., which infests places where old branches have been badly pruned and seems to be parasitised by small Ichneumonids.

Cotton is attacked by *Platyedra* (*Pectinophora*) *gossypiella*, Saund., which is parasitised by the Braconid, *Chelonus blackburni*, Cam., the Ichneumonid, *Pimpla* (*Ephialtes*) *hawaiiensis*, Cam., and the Chalcid, *Brachymeria* (*Chalcis*) *obscurata*, Wlk. ; *Saissetia nigra*, Nietn., controlled by fungi, etc. ; the mealybugs, *Pseudococcus filamentosus*, Ckll., and *P. brevipes*, Ckll., which are little in evidence, being kept in check by natural enemies, including *Rhizobius ventralis* and *Cryptolaemus montrouzieri* ; *Aphis gossypii*, Glov., parasitised by *Lysiphlebus* sp. ; and *Pyroderces* (*Batrachedra*) *rileyi*, Wlsm., which is preyed upon by the wasps, *Polistes aurifer*, Sauss., *P. hebraeus*, F., and *Pachodynerus simplicicornis*, Sauss. Minor pests of cotton are the Rutelid, *Adoretus sinicus*, Burm., the larvae of which attack the roots, *Elimaea punctifera*, *Euthrips hawaiiensis*, Morgan, and *Araecerus fasciculatus*, DeG., which is found in and about the bolls.

Tomato pests are *Heliothis obsoleta*, F., which is not very injurious ; the Capsid, *Engytatus geniculatus*, Reut., which is the most serious pest of this crop ; and *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., which is heavily parasitised by *Opius fletcheri*, Silv., but also infests cucumbers. *Aphis gossypii* on cucumber is attacked by *Allograpta obliqua*, *Platyomus lividigaster* and *Coelophora inequalis*. Pests of cabbage are cutworms, which are probably controlled by the Tachinid, *Archytas cirphis*, Curran ; *Plutella maculipennis*, Curt., which is parasitised by the Ichneumonid, *Eulimneria* (*Limnerium*) *polynesialis*, Cam. ; *Brevicoryne brassicae*, L., parasitised by small Braconids ; *Agromyza pusilla*, Mg. ; and *Pieris* (*Pontia*) *rapae*, L., from a pupa of which *Brachymeria obscurata* was collected. Beet and spinach are attacked by *Hymenia recurvalis*, F., and *Aphis gossypii*.

Pests of *Citrus* are *Coccus viridis*, which is troublesome on orange grown near coffee, *Ceratitis capitata*, which is well controlled by natural

enemies, *Phyllocoptes oleivorus*, Ashm., which occurs on the foliage and fruit ; and *Pantomorus godmani*, Crotch, which congregates among the leaves and twigs, the larvae feeding in the soil on the root tips. The Syrphid, *Volucella obesa*, F., lays its eggs on the bark of papaya [*Carica papaya*], and the larvae work their way into the stem. The Stratiomyiid, *Neoexaireta spinigera*, Wied., oviposits in the wounds caused by *Volucella*, and larvae and adults of the Staphylinid, *Philonthus discoideus*, Grav., and the Hydrophilid, *Dactylosternum abdominale*, F., feed on the eggs and larvae of these flies. *Amorbia emigratella*, Busck, is numerous on young macadamia nut trees [*Macadamia ternifolia*]. The eggs, which are laid on the upper surface of the leaves, are often parasitised, and the Tettigoniid, *Xiphidiopsis lita*, Hebard, and *Pheidole megacephala*, F., attack the larvae. *Pimpla hawaiiensis*, which has been recorded as a parasite of *A. emigratella*, was also present in abundance. Bananas showed signs of attack by adults of *Adoretus sinicus*. *Pseudococcus brevipes* was the only pest observed on wild pineapple.

Agromyza lantanae, Frogg., and *Teleonemia lantanae*, Dist., exercise an effective check on the spread of *Lantana*, which is also attacked by *Platyptilia pusillidactyla*, Wlk., and *Callicista thius*, Hb. (*Thecla bazochii*, Godt.). Although *Eutreta xanthochaeta*, Ald., is everywhere in evidence and its galls are plentiful, it does little to check the growth, and *Cremastobombycia lantanella*, Busck, is not sufficiently abundant to reduce the foliage. *Saissetia nigra* was found on scattered guava plants, but has little effect on them and is infested by a fungus. Guava appears to be almost free from natural enemies in the Kona district, and even the fruit showed little infestation from *Ceratitis capitata*.

Illingworth (J. F.). **Pests of Pineapple in Hawaii.**—*Proc. Hawaii. Ent. Soc.*, vii, no. 2, pp. 254–256. Honolulu, December 1929.

Pests of the root system of pineapple in Hawaii include numerous species of Collembola and *Rhizoglyphus phylloxerae*, Riley. *Pseudococcus brevipes*, Ckll., attacks the young roots and together with *Diaspis bromeliae*, Kern., congregates on weakened plants, although both Coccids are kept well in check by natural enemies. The larvae of *Pyroderces* (*Batrachedra*) *rileyi*, Wlsm., live in the withered flowers and gnaw the leaves of the crown, and rot-organisms enter through the wounds thus caused and break down the fruits. Some 5 exotic species of Nitidulids are found in pineapple fields, the most injurious and abundant being *Carpophilus humeralis*, L., which attacks the plant at every stage of its growth. The adults congregate on the butts, gnawing out the starchy material between the fibres, and the larvae often feed at the base of the leaves, where rot-fungi are introduced. When numerous, they gnaw cracks between the lower eyes of the fruit, and fermentation follows. The larvae of *Apelma brevis*, Johannsen, are always present in the water pockets between the leaves of the growing plants, and occasionally rasp the tender white tissue at the base of the new leaves, thus permitting the entry of rot-organisms. *Stigmaeus floridanus*, Banks, is widely distributed on pineapple, but has never caused serious injury. Minor pests include *Japyx* sp., *Pycnoscelus surinamensis*, L., *Adoretus sinicus*, Burm., and *Pantomorus godmani*, Crotch, on the roots ; and *Oxya velox*, F. (*chinensis*, Thunbg.), *Atractomorpha ambigua*, Bol., *Gryllus oceanicus*, Le Guill., *Atherigona excisa*, Wied., *Euxesta annonae*, F., and *Drosophila repleta*, Woll., on the fruit, stem or leaves.

Illingworth (J. F.). **Grasshoppers eat Pineapple Mealy Bugs and other Pests.**—*Proc. Hawaii. Ent. Soc.*, vii, no. 2, pp. 256–257. Honolulu, December 1929.

The sudden disappearance of mealybugs [*Pseudococcus brevipes*, Ckll.] from pineapple plants that had recently been heavily infested was found to coincide with the presence upon them in numbers of *Conocephalus saltator*, Sauss., which has previously been recorded as largely predacious on the sugar-cane leaf-hopper [*Perkinsiella saccharicida*, Kirk.], feeding sparingly on the flowers of *Lantana* and *Canna* and the leaves of honohono [*Commelina nudiflora*], but seldom touching sugar-cane.

In feeding tests in which 6 half-grown hoppers were placed in separate glass tubes, each supplied with 20 mealybugs and flowers of pigeon pea [*Cajanus indicus*] and lucerne, the mealybugs were quickly devoured, whereas the flowers were only very slightly attacked. Fresh mealybugs were put into each tube as soon as the supply became exhausted, and the maximum number consumed in a single tube in a week was 110. *C. saltator* also showed a liking for the larvae and pupae of various bud moths, but manifested no inclination to eat pineapple foliage, though the blossoms were very slightly damaged. Although doubtless a valuable predator, it does not thrive except in fields where weeds as well as insect pests are numerous.

Swezey (O. H.). **Records of immigrant and recently introduced Insects on Kauai.**—*Proc. Hawaii. Ent. Soc.*, vii, no. 2, pp. 271–273. Honolulu, December 1929.

The insects recorded for the first time on the Island include : *Phthorimaea lycopersicella*, Busck, and *Engytatus geniculatus*, Reut., on tomatos ; *Xiphidiopsis lita*, Hebard ; a Bruchid allied to *Bruchus coryphae*, Ol., eggs of which were found in capsules of *Ipomoea pes-caprae* ; *Coccotrypes pygmaeus*, Eichh., attacking date seeds ; *Ripersia palmarum*, Ehrh., on coconut ; and *Thoracaphis fici*, Baker, on leaves of *Ficus retusa*. *Bactra truculenta*, Meyr., was found to be fully established on nut-grass [*Cyperus rotundus*]. *Telenomus nawai*, Ashm., which was reared from the eggs of *Spodoptera mauritia*, Boisd., collected from the leaves of palm and sugar-cane, had not previously been known to be established on the Island. *Cremastus hymeniae*, Vier., was found to have parasitised 85 per cent. of the larvae of *Lamprosema* (*Omiodes*) *blackburni*, Butl., infesting a small coconut tree. A cocoon of *Hyposoter exiguae*, Vier., and a single individual of *Curinus coeruleus*, Muls., a Coccinellid introduced from Mexico, were also observed ; neither of these insects had previously been known to be established.

Swezey (O. H.). *Sitophilus rugicollis* **(Casey) in Hawaii (Col., Curculionidae).**—*Proc. Hawaii. Ent. Soc.*, vii, no. 2, p. 279. Honolulu, December 1929.

One individual of *Calandra* (*Sitophilus*) *rugicollis*, Casey (*shoreae*, Mshll.), which attacks *Shorea robusta* and *Dipterocarpus turbinatus* in India [*R.A.E.*, A, ix, 90 ; xii, 344], has been found in a house in Honolulu.

Swezey (O. H.). **Notes on the Egg-parasites of Insects in Hawaii.**—*Proc. Hawaii. Ent. Soc.*, vii, no. 2, pp. 282–292. Honolulu, December 1929.

An annotated list is given of all those insects in Hawaii known to parasitise or otherwise destroy the eggs of other insects, including native species, natural immigrants, and those deliberately introduced.

Smee (C.). **Tea Mosquito Bug in Nyasaland** (*Helopeltis bergrothi*, **Reut.**) **and Notes on two potential Pests of Tea, (1) the Tea Leaf Weevil** (*Dicasticus mlanjensis*, **Mshl.**) **(2) the Bean Flower Capsid** (*Callicratides rama*, **Kirby**).—*Bull. Dept. Agric. Nyasaland*, Ent. Ser., no. 4, 10 pp., 5 pls., 2 refs. Zomba, October 1928.

Helopeltis bergrothi, Reut., all stages of which are briefly described, is a potential pest of tea in Nyasaland, where it is numerous without having hitherto caused any considerable loss to the crop. The maximum number of eggs laid by a single female probably does not exceed 100 over a period of 2 months, the largest number from one female obtained in captivity being 68 over a period of 18 days, during which mating occurred twice. The number of eggs laid at a time is usually small, but one female was observed to lay 28 in a day. During February and March the eggs hatch in 14–16 days, and the nymphal stage, during which 4 moults occur, lasts 25–27 days. The length of the life-cycle gradually increases until in May and June it requires 60–71 days, the nymphal stage lasting 40–43. The nymphs feed chiefly on the young leaves produced in the lower parts of the bush, but the adults feed at the extremities of the plant. All stages are most active in the early morning or evening, the nymphs hiding in the centre of the bushes and the adults on the lower surfaces of the leaves during the hottest part of the day. The leaves may be attacked from either the lower or upper surface, and the soft green stems are also sucked, though only a small brown patch results unless the feeding is carried on for a long period. A description is given of the injury caused to the leaves, which finally shrivel and curl up, the shoot being quite dry and brittle 3 days after attack. A fungous disease of tea leaves, due to *Phoma* sp., produces marks similar to those caused by the adults, and is often found in association with them. Assuming the life of the adult to last 60–75 days, the active feeding of the bug may cover 85–118. It is estimated that one individual can destroy two shoots a day, and as 1 lb. of green leaf contains 930–950 shoots of three leaves and a bud, only 4–6 Capsids will be required under favourable conditions to destroy this quantity. *H. bergrothi* continues under favourable conditions to breed throughout the year, and in view of what is at present known of the seasonal variations in its life-cycle 3 generations would be sufficient to carry the bug over the entire year. At the most rapid rate of development, however, 7–8 generations may be completed within 12 months.

Observations for several years indicate that an outbreak of this Capsid may be expected in seasons having many rainy days, although the total rainfall of the year may not be excessive, the amount of rainfall during November–February being of particular importance. In one year a loss of 13,000 lb. of crop from a field of 27 acres was almost certainly due to its attack. Where soil conditions are unsuitable to the tea plants, the latter are particularly subject to infestation. Although pruning keeps the bug in check from year to year and its

numbers decline in the dryer months, any areas carrying foliage all the year round provide suitable breeding grounds that may facilitate rapid development early in the flushing season.

The habits of both nymphs and adults render difficult the successful employment of insecticides. Drenching the bushes with lime-sulphur when the nymphs are numerous may be effective in nurseries of special value. Pruning in advance of the normal time may be desirable where large numbers of eggs have been observed on young shoots, the prunings being burnt or buried deeply. A belt of unpruned bushes, on which they can subsequently be collected by hand, should be left around the treated area to attract the adults, which are otherwise liable to migrate to adjacent plantings still bearing foliage. The employment of hand-collecting gangs should serve in normal seasons to keep *H. bergrothi* within reasonable bounds. First attention should be given to nurseries and unpruned bushes and to bushes adjacent to damp low-lying places having a continuous growth of rank grasses and weeds that afford shelter for the bugs in the dry months. No natural enemies of any consequence have been observed in Nyasaland. Although this Capsid has hitherto been recorded only from cotton, mango and guava in addition to tea in Nyasaland, it has been found on numerous food-plants in other parts of Africa.

Most of the information given in regard to *Dicasticus mlanjensis*, Mshll., and *Callicratides rama*, Kirby, has already been noticed [*R.A.E.*, A, xvi, 75 ; xvii, 172]. The adults and eggs of both insects are briefly described, and the characters distinguishing *C. rama* from *H. bergrothi*, which it closely resembles, are indicated. The length of its egg stage is unknown, but the nymphal stage lasts only 14–16 days.

Papers noticed by Title only.

Waterston (J.). **On the Differential Characters of *Chelonogastra* Ashmead and *Philomacroploea* Cameron, two Genera of Ichneumon Flies of the Family Braconidae (Hymenoptera).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 8, pp. 167–168. Washington D.C. November 1929.

Allen (H. W.) & Jaynes (H. A.). **Contribution to the Taxonomy of Asiatic Wasps of the Genus *Tiphia* (Scoliidae).**—*Proc. U.S. Nat. Mus.*, lxxvi, art. 17, no. 2814, 105 pp., 4 pls., 1 fig. Washington, D.C., 1930.

Golledge (C. J.). **The Insect Pests of Books. An annotated Bibliography** [29 Titles, 1898–1928, to supplement those in Houlbert's Bibliography, 1903].—*Libr. Ass. Rec.*, N.S., vii, no. 28, pp. 240–242. London, December 1929.

Murase (K.). **A List of Insect Pests of *Diospyros kaki*** [Oriental Persimmon]. [*In Japanese.*]—*Insect Wld.*, xxxiv, pp. 87–92. Gifu, March 1930.

Takahashi (R.). **List of the Aphid Genera proposed as new in recent Years.**—*Proc. Ent. Soc. Wash.*, xxxii, no. 1, pp. 1–24, 4 pp. refs. Washington, D.C., January 1930.

Green (E. E.). **A brief Review of the indigenous Coccidae of the British Islands.**—*Ent. Rec.*, xxxix, pp. (1)–(4), 1 pl. ; xl, pp. (5)–(14), 3 pls. London, December 1927 & January & March 1928.

Chorine (V.). **Nouveaux microbes pathogènes pour les chenilles de la pyrale du maïs** [*Pyrausta nubilalis*, Hb.].—*Ann. Inst. Pasteur*, xliii, no. 12, pp. 1657–1678, 6 figs., 7 refs. Paris, December 1929. [*Cf. R.A.E.*, A, xviii, 143.]

SWEZEY (O. H.). **The Hosts of *Cremastus hymeniae* Viereck in Hawaii.** —*Proc. Hawaii. Ent. Soc.*, vii, no. 2, p. 281. Honolulu, December 1929.

In connection with the recent introduction from Hawaii into Fiji of the Ichneumonid, *Cremastus hymeniae*, Vier. [*R.A.E.*, A, xviii, 11], a list is given of 29 Lepidopterous hosts of this parasite in Hawaii, including *Chilo simplex*, Butl., *Cryptophlebia* (*Argyroploce*) *illepida*, Butl., *Crocidosema lantana*, Busck, and *Pyroderces rileyi*, Wlsm.

[SHVETZOVA (A. N.).] **Швецова (А. Н.). On the Question of the Importance of agricultural Methods of the Control of the Frit Fly. (According to Observations in 1927-29.)** [*In Russian.*]—*Trud. Zap.-Sib. oblastn. S.-Kh. opuitn. Stantz. Otd. Polevod.*, no. 27, 28 pp., 4 diagrs., 8 refs. Omsk, 1930.

This is an account of observations on *Oscinella frit*, L., in the Omsk Government from 1927 to 1929, a preliminary report for 1927 having already been noticed [*R.A.E.*, A, xviii, 51]. Owing to considerable rainfall in the spring and summer of 1928, the cereals were better developed and possessed more power of resistance than under the dry conditions of 1927 and 1929 ; in the latter year, however, low temperatures in spring, especially in May, considerably retarded the pupation of the overwintered larvae, and the drought and extreme heat in the summer were unfavourable to the second generation and reduced the infestation of winter crops to a minimum. The biological cycle of the fly for the three years is briefly reviewed, the periods of development of the larvae and pupae being shown in tables.

Observations indicated that winter rye may be safeguarded by late sowing, the best time being between 20th August and 1st September. Severely infested plants are less resistant to cold and are killed by the Siberian winter. Rotation of crops and improved cultivation increases the resistance of rye.

In the case of summer wheat no definite recommendations can be made as regards the time for sowing ; early sowing is best in cold springs, when the emergence of the adults is retarded, whereas in early and hot springs late sowing may avoid severe infestation. The effect of the type of fallow on infestation also varies according to meteorological conditions. Chemical manures had little effect on the resistance of summer wheat, slightly better results being obtained with phosphorus manures. Infestation is higher if the density of sowing is below the normal of about 270 lb. to 2½ acres. Rotation of crops decreases the infestation, especially if the wheat is sown in fields previously used for beet, turnips or maize.

Further work is required on the resistance of different varieties of wheat and on the effect of infestation on the ultimate crop ; the infested plants apparently tiller more profusely, but their yield is less. Infestation of the stubble of summer wheat is higher in cases of late sowing and a late maturing variety, when the burning of the stubble in the field would be an effective measure ; this would also kill thrips, which cause considerable damage, especially in dry years.

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[YAKHONTOV (V. V.).] **Яхонтов (В. В.). Adaptation of Cotton Pests to Weeds in the Region of Bokhara.** [*In Russian.*]—*Trudui Shirabud. opuitn. s.-kh. Sta. Otdel Zashch. Rast.* (*Works Agric. Expt. Sta. Old Bokhara* (*Shirabudin*), *Dept. Plant. Prot.*), no. 1, 28 + vii pp., 113 refs. Staraya Bukhara, 1928.

Notes are given on 48 pests of cotton observed in the Bokhara region in 1926 and 1927, showing the alternative food-plants of each on the basis of personal observations and data from the literature. Most of the pests are general feeders, migrating from cultivated plants to weeds and *vice versa*.

[YAKHONTOV (V. V.).] **Яхонтов (В. В.). List of Pests of economic Plants in the Region of Bokhara and of their Parasites and Insect Predators.** [*In Russian.*]—*Trudui Shirabud. opuitn. s.-kh. Sta. Otdel Zashch. Rast.*, no. 2, 46 pp., 12 figs., 22 refs. Staraya Bukhara, 1929.

This list includes 6 mites and 171 insects injurious to cultivated crops in the Bokhara region, with notes on their food-plants and the extent of the damage caused. Descriptions in English and Russian are given of the adult and second instar larva of *Anaphothrips* (*Hemianaphothrips*) *shirabudinensis*, sp. n., and the adult of *Thrips gossypii*, sp. n., both infesting cotton, and of the larva of the Noctuid, *Euxestis dentula*, Ld., which damages pomegranates. Annotated lists of insects predacious or parasitic on the pests, arranged under the hosts, are also given, and phenological notes for the years 1926–28 and part of 1929 recorded from the Shirabudin (Old Bokhara) Agricultural Experiment Station are appended.

ISHII (T.). **The Encyrtinae of Japan.**—*Bull. Imp. Agric. Expt. Sta. Japan*, iii, no. 2, pp. 79–160, 57 figs., 3 pp. refs. Nishigahara, Tokyo, November 1928. [Recd. May 1930.]

In this paper are recorded the 73 species of Encyrtids known to occur in Japan, most of which are described. Of this number 41 have not hitherto been recorded from the country, and include 34 new to science. Among the latter are *Anagyrus alboclavatus* from *Pseudococcus* sp. on *Ficus erecta*; *A. flavus* from *Pulvinaria* sp. on *Mallotus japonicus*; *A. sawadai* from *Eriococcus* sp. on *Cryptomeria japonica*; *A. subalbipes*, *Cheiloneurus nagasakiensis* and *Leptomastix citri*, all from *Pseudococcus* on *Citrus*; *Anicetus ceroplastis* from *Ceroplastes ceriferus*, And.; *Blastothrix kermivora* from *Kermes miyasakii*, Kuw., and *K. nawae*, Kuw.; *Cheiloneurus tenuicornis* from *K. miyasakii*; *Encyrtus sasakii* from *Kermes* sp. and *Takahashia* sp., both on *Celtis sinensis*; *Microterys kuwanai* from *Coccus hesperidum*, L., *Lecaniodiaspis quercus*, Ckll., *Pulvinaria camelicola*, Sign., and *P. horii*, Kuw.; *Ooencyrtus nezarae* from the eggs of the Pentatomid, *Nezara antennata*, Scott; *Phaenodiscus eriococci* from *Eriococcus lagerstroemiae*, Kuw., and *E. onukii*, Kuw.; and *Psyllaephagus iwayaensis* and *Psylledontus viridiscutellatus* from Psyllids on *Cinnamomum* sp. and *Elaeagnus umbellata* respectively.

Fiji: Noxious Weeds and Diseases of Plants Ordinance 1929.—5 pp. Suva, 18th November 1929.

Under this Ordinance, which repeals previous ones, the Governor-in-Council may prohibit the importation into Fiji of any plant. Plants may only be imported at specified ports and are liable to inspection. Any imported plants found infested with insect pests or disease are destroyed. All plants imported must be certified by the exporting country as being free from pests or disease. The introduction of plants through the post must be notified. Any work prescribed for the eradication or prevention of spread of any pest or disease, if not carried out by the occupier of the land in question, may be performed by an inspector at the occupier's expense. The Governor may proclaim any district an infested area.

India: The Destructive Insects and Pests (Amendment) Act 1930.—*Gaz. India*, 5th April 1930, pt. iv, p. 59. Delhi, 1930.

The Destructive Insects and Pests Act of 1914 [*R.A.E.*, A, ii, 273] is amended to provide for precautions against the introduction of insects or other pests into India by air traffic.

MILLER (N. C. E.). *Megymenum brevicorne* **F. Pentatomidae (Hemiptera-Heteroptera). A Minor Pest of Cucurbitaceae and Passifloraceae.**—*Malayan Agric. J.*, xvii, no. 12, pp. 421–436, 7 figs., 4 refs. Kuala Lumpur, December 1929.

Descriptions are given of all stages of *Megymenum brevicorne*, F., which attacks grenadilla (*Passiflora quadrangularis*), pumpkin (*Cucurbita maxima*), and snake gourd (*Trichosanthes anguina*) in Malaya. The eggs are laid in a chain on the upper or lower surfaces of the leaves or on the stems, 18 being the maximum number deposited by one female in the laboratory. The total life-cycle from the deposition of the egg to the death of the adult is about 95 days, the nymphal stage, which comprises 5 instars, covering about 74. The stems and fruits of the plant are the parts mainly subject to attack. The adults or nymphs may be collected early in the morning by shaking them off the plants on which they are feeding into a tin containing water with a film of kerosene, and the eggs may be easily discovered and destroyed by crushing.

PESCOTT (R. T. M.). **Spraying Costs in Codling Moth Control.**—*J. Dept. Agric. Victoria*, xxvii, pt. 11, pp. 672–673. Melbourne, November 1929.

The practicability of replacing lead arsenate by white oil emulsions in cover sprays against the codling moth [*Cydia pomonella*, L.] in Victoria has been questioned in view of the higher cost of the oils. On the assumption that 80 gals. of spray is the minimum required for the trees that will produce 100 cases of apples, the cost of two calyx and four cover sprays of lead arsenate (5 lb. to 80 gals.) is estimated at £1, and that of two calyx sprays of lead arsenate followed by three oil sprays (2½ per cent.) at £2 14s. 8d. In the course of two years' experiments (1927–28–29), 36 per cent. of the fruit that received five or six applications of lead arsenate was infested, as compared with

only 12 per cent. of the fruit treated with two lead arsenate calyx sprays followed by three sprays of white oil emulsion. This alone more than justifies the cost of the oil, which also gives complete control of the San José scale [*Aspidiotus perniciosus*, Comst.], the apple mussel scale [*Lepidosaphes ulmi*, L.] and mites.

BOSELLI (F. B.). **Elenco delle specie d'insetti dannosi ricordate per la Libia fino al 1926.** [Catalogue of injurious Insects recorded in Libya up to 1926.]—*Ann. R. Ist. sup. agrar. Portici*, (3) iii, pp. 281–307. Portici, 1930.

This catalogue consists of a bibliography, a list of the insect pests in alphabetical order by genera, showing the order, family and distribution of each pest, and in many cases the food-plants, and indicating the papers in which it is recorded, and a list of insect predators and parasites, with the hosts in some instances.

SEYDEL (C.). **Rapport entomologique pour la Province du Katanga (Année 1928).**—*Bull. agric. Congo belge*, xx, no. 2, pp. 228–237. Brussels, June 1929.

A list is given of the insects observed on cultivated plants, including cotton, potatoes, sweet potatoes, coffee, maize and *Citrus*. The most important pest is *Platyedra* (*Gelechia*) *gossypiella*, Saund. (pink bollworm), which was discovered on cotton in 1927. The original infestation was traced to cotton seed from Manyema. The usual measures against this pest are enumerated, and the necessity for ensuring thorough disinfection of the seed is emphasised. *Phthorimaea operculella*, Zell. (potato moth) was the cause of serious damage in one district, following prolonged storage owing to lack of transport facilities, several hundred tons of potatoes being rendered useless. *Sesamia vuteria*, Stoll (maize borer) is also liable to cause serious damage, but can be controlled by the total destruction of the stubble after gathering the crop.

BORG (P.). [**Report of the**] **Plant Pathologist.**—*Ann. Rep. Dept. Agric. Malta 1928–29*, pp. xii–xv. Malta, 1929.

Notes are given on injurious insects occurring in Malta during 1928–29. Soil injections of carbon bisulphide gave good results against *Phylloxera*, and in one locality many vines have been replaced by new ones on American stocks. *Icerya purchasi*, Mask., is thoroughly controlled by the Coccinellid, *Novius cardinalis*, Muls., which is now firmly established in both islands, having survived a severe winter. Good results against armoured scales, particularly *Chrysomphalus dictyospermi*, Morg., *Aulacaspis pentagona*, Targ., *Lepidosaphes ulmi*, L., and *Parlatoria zizyphus*, Lucas (*lucasi*, Targ.), were obtained by systematic treatment with a spray containing 0·5 per cent. [potassium] sulphocarbonate and soap. As a result of soil injections with carbon bisulphide to kill the pupae of *Ceratitis capitata*, Wied. (European fruit-fly), a large proportion of *Citrus* fruits escaped injury until the activities of the fly were checked by adverse weather conditions. Definite control by artificial means is probably impossible, however, since the fly also breeds in wild capers, besides attacking numerous varieties of fruit; furthermore, it has been proved experimentally that it can hibernate in the pupal stage in mature caper fruit.

Good results against *Eriosoma lanigerum*, Hausm. (woolly apple aphis) on apple, were obtained by spraying the partly exposed roots and branches with 0·2 per cent. potassium permanganate and injecting carbon bisulphide into the soil. In orchards so treated, the Aphid was very scarce during the summer and appeared only late in the season on a few twigs. Early in the spring considerable injury was caused by various Aphids to fruit trees, ornamental plants and particularly *Citrus*. The Coccinellids, *Chilocorus bipustulatus*, L., *Exochomus quadrimaculatus* [? *quadripustulatus*, L.] and *Coccinella septempunctata*, L., which commonly migrate from Sicily and Libya and check the activities of Aphids, were less abundant than usual. *Brevicoryne* (*Aphis*) *brassicae*, L., and the Halticids, *Haltica oleracea*, L., and *Phyllotreta nemorum*, L., in many cases completely destroyed seedling cabbages and other crucifers. Unusually large numbers of immigrants of *Pieris rapae*, L., and to a less extent of *P. brassicae*, L., reached Malta, probably from the African coast, and caused serious injury to cabbage, etc. The parasite, *Apanteles glomeratus*, L., which normally keeps both these butterflies in check, was not sufficiently abundant to control them.

Borg (P.). **Entomological Notes.**—9 pp. typescript. Malta Dept. Agric., received March 1930.

During the past few years a number of carob trees [*Ceratonia siliqua*] have been killed by the Buprestid, *Ptosima undecimmaculata*, Hbst. (*novemmaculata*, F.). The adults appear in May and lay numerous eggs in crevices in the larger branches, particularly those reaching out furthest from the trunk. The larvae tunnel under the bark, becoming full-grown after two years. By cutting off and burning the infested branches it has been possible, in many cases, to save the trees. This beetle is common in Italy, where it attacks elms and various stone fruits.

An instance is recorded of a few leaf-galls of *Phylloxera* occurring on two European vines growing among a number of American varieties that were covered with them.

In exceptionally dry years, probably owing to the scarcity of its natural food-plants, *Allophylax* (*Phylax*) *melitensis*, Baudi, has caused considerable injury to seedlings of tomatos and cotton, by gnawing the stems and removing the bark. This Tenebrionid is very common, and large numbers are observed early in the summer feeding on wild plants and the remains of crops recently removed from the field. Characters distinguishing the adults and those of *A.* (*P.*) *picipes*, Ol. (*littoralis*, Muls.), from which it is considered specifically distinct, are indicated. Good results were obtained by lightly dusting the plants with lead arsenate, and also by means of baits made of offal and lead arsenate worked into a paste with water.

Artichokes, especially on clayey, moist soils or in shady valleys, are often attacked by the Lamiid, *Agapanthia cardui*, L., the larvae of which tunnel in the petioles of the leaves and sometimes in the crown of the main stem. The adults occur from March to September. The larvae of another Lamiid, *Acanthoderes clavipes*, Schr. (*varia*, F.) attack the young branches of pomegranate, forming galleries in the heartwood. This beetle is fairly abundant in moist and shaded areas,

especially on irrigated land where the plant is grown to form hedges. The adults appear in March and lay their eggs in cracks in the bark.

In the spring of 1925 numbers of cotton bolls were injured by *Earias chlorana*, L. A minor outbreak occurred the following year. It is thought that by collecting and burning the infested bolls the damage was greatly reduced. In Britain the larvae of this moth feed on willow. In the spring of 1923 *Diloba coeruleocephala*, L. completely defoliated a large number of almond trees. The full grown larvae of this Noctuid have sometimes been found feeding on the leaves of plum, apple and pear, but never in such numbers. Birds, particularly the house-sparrow, which prey on the larvae, are probably responsible for the comparative rarity of the adults. Spraying with 5 per cent. lead arsenate gave good control.

In 1924 crops of cumin were destroyed by the larvae of *Phytometra* (*Plusia*) *gamma*, L., the young plants being eaten to the ground at the time of flowering. The infestation was checked by treatment with coal tar preparations, the larvae being repelled from the sprayed plants and even killed by contact. Comparatively small numbers of the larvae of *Acherontia atropos*, L. (death's head moth) occur every year on the leaves of the late winter crops of potatoes, between August and November. The most important natural enemy of this Sphingid is a Tachinid parasite.

The Coccinellid, *Novius cardinalis*, Muls., established for the control of *Icerya purchasi*, Mask. [see preceding paper] does not readily attack this scale when it is feeding on certain plants, such as Spanish broom and *Plumbago zeylanica* ; *Pittosporum tobira* was found to be the most suitable plant for breeding the Coccinellids both in the field and the insectary.

Three or four applications at intervals of 20 days of a spray consisting of a 2 per cent. solution of potassium permanganate completely destroyed *Chrysomphalus dictyospermi*, Morg., *Aulacaspis pentagona*, Targ., *Lepidosaphes ulmi*, L., and *Parlatoria zizyphus*, Lucas (*lucasi*, Targ.) on *Citrus*. *C. dictyospermi* proved to be the most resistant. The spray caused no injury to the trees even when used at a higher concentration.

Three years in succession plantings of cauliflowers and cabbages were destroyed by the larvae of *Eupithecia pulchellata*, Steph., which gnaw the buds and mine the stems of the young plants. They were most active during October and November on the late winter crops and disappeared by about December. The seedlings require about 3 weeks to become firmly established after which they are less liable to be attacked. Dusting with a mixture of equal parts of sulphur and copper sulphate every eight days for three or four weeks after planting gives good control.

In 1925 some crops of sesame (*Sesamum*) were destroyed by the larvae of the Pyralid, *Antigastra catalaunalis*, Dup. Since no external injury to the pods is visible, it would appear that the eggs are laid on the flowers and the larvae on hatching reach the ovary and grow with it, eating the forming seeds. Usually each pod contains only one larva. On reaching maturity the larvae bore out of the pod and pupate in the ground. Outbreaks of this moth on *Sesamum* only occur at intervals of several years. Its usual food-plant in southern Europe is *Linaria* (toad-flax), several species of which are found in Malta. Oviposition on sesame may perhaps be the result of infestation by Aphids, the moths being attracted to the plants to feed on the Aphid honey-dew.

TONON (A.). **Azione dei vapori di catrame sulle uova di filugello.** [The Action of Tar Fumes on Silkworm Eggs.]—*L'Indust. bacol.*, iv, no. 1, pp. 5–10, 1 fig., 14 refs. Milan, January 1930.

The fumes of wood-tar or coal-tar and their derivatives, which are often used as disinfectants against diseases of the silkworm [*Bombyx mori*, L.] are injurious to its eggs, and care is necessary to avoid such materials in places where eggs are stored.

GRANDI (G.). **Contributo alla conoscenza della** *Tischeria gaunacella* **Dup., ed appunti sulla** *Tischeria complanella* **Hbn. (Lepidoptera-Tischeriidae).** [A Contribution to the Knowledge of *T. gaunacella* and Notes on *T. complanella*.]—*Boll. Lab. Ent. R. Ist. sup. agrar. Bologna*, ii, pp. 192–245, 5 pls., 24 figs. Bologna, 1st October 1929.

A detailed description of the morphology of all stages of *Tischeria gaunacella*, Dup., is given. It attacks various kinds of *Prunus* and was observed at Bologna on *P. cerasifera pissardii*, a common ornamental tree of which it injures the appearance by mining the leaves. At Bologna the larvae of the first generation occur in May and June, those of the second in June and July, and those of the third in August-October, when they begin to hibernate. This third generation pupates in the following spring, the adults flying in May. Two Chalcids, *Derostenus* sp. and *Tetrastichus* sp., were found to be parasites of the larvae. The adult of the former and the larva of the latter are described. Descriptions are also given of the larva of *Tischeria complanella*, Hb., which mines the leaves of oak and chestnut, and of the adults of two Chalcids obtained from it, *viz.*, *Closterocerus trifasciatus*, Westw., and *Cirrospilus* sp.

RIESGO ORDÓÑEZ (A.). **La fauna del Valle de los Pedroches.** [The Fauna of the Pedroches Valley.]—*Rev. Fitopatol.*, iv–vi (1926–28), pp. 53–58. Madrid [1929]. *Rev. Biol. for. Limnol.*, i (A), no. 2, pp. 108–115. Madrid, 10th December 1929.

The first part of this paper records the insects observed in the Valle de los Pedroches, Cordoba, Spain, situated at an altitude of about 2,500 ft., and the second deals with those that are pests of oaks. *Vanessa polychloros*, L., also recorded from pear, infested oak in the spring of 1929, when it was very numerous. *Hylophila* (*Chloëphora*) *bicolorana*, Fuessl., is often associated with *Tortrix viridana*, L., and has similar habits. A table is given showing the seasonal occurrence of the stages of *T. viridana* as observed from 1921 to 1929. The larvae can resist starvation for 8–9 days and migrate from trees defoliated by *Porthetria* (*Lymantria*) *dispar*, L., owing to lack of food. In some forests in which *Porthetria* has been controlled, however, an outbreak of *Tortrix* seems probable. Several species of birds are recorded as feeding on the larvae. *Malacosoma neustria*, L., has been a serious pest of oaks since about 1921. The seasonal occurrence of the stages is shown in a table. If the larvae appear in advance of the buds, the latter are destroyed on opening and the acorn crop fails; all the young leaves are eaten, but few, if any, of the old ones. Larvae appearing at the same time as the buds eat the leaf-buds primarily and also many old leaves, and much of the acorn crop is saved. If

they hatch after budding, all the new leaves and many of the old ones are eaten, but the crop is not affected. Like *T. viridana*, *M. neustria* does not occur on trees infested by *P. dispar*. Natural enemies are of considerable importance in its control ; they include birds and *Carabus gougeleti*, Reich., as well as the parasites, *Ooencyrtus masii*, Mercet, *Tricholyga grandis*, Zett., *Brachymeria* (*Chalcis*) *intermedia*, Nees, *Exorista* (*Parexorista*) *confinis*, Fall., and *Pimpla maculator*, F. Measures for control include collection and destruction of the larval nests ; arsenical sprays ; and spraying with water, which causes the caterpillars to drop to the ground, adhesive bands being applied to prevent them from crawling up the trees again and an oil spray being used to kill them.

Aulló Costilla (M.). **Principales enemigos y enfermedades de las repoblaciones en España.** [The chief Pests and Diseases of restocked Trees in Spain.]—*Rev. Biol. for. Limnol.*, i (A), no. 2, pp. 77–82. Madrid, 10th December 1929. (With a Summary in French.)

Pests of conifers have acquired a greater importance in Spain than those of deciduous trees because they have been extensively used for re-afforestation and are also more severely infested. The principal insects attacking the foliage are *Amphimallus pini*, Ol. ; *A. majalis*, Razm. (*rufescens*, Latr.) ; *Polyphylla fullo*, L. ; *Brachyderes suturalis* Graëlls ; *Thaumetopoea pityocampa*, Schiff. ; *Dendrolimus pini*, L. ; *Acantholyda* (*Lyda*) *hieroglyphica*, Christ ; and *Diprion* (*Lophyrus*) *sertifer*, Geoffr. Arsenical sprays have proved effective against *B. suturalis* and *A. hieroglyphica*, and petroleum emulsions against *D. sertifer*. Injections of petroleum into the nests of *T. pityocampa* kill the caterpillars, while the adults of the parasite, *Anomalon* [*latro*, Schr.] are able to make their escape. *Rhyacionia* (*Evetria*) *buoliana*, Schiff., and *R.* (*E.*) *duplana*, Hb., and the adults of *Myelophilus piniperda*, L., attack the buds and shoots. The larvae of *M. piniperda* infest the roots, trunk and branches, other pests of which are *Pissodes notatus*, F., the most injurious insect attacking replanted *Pinus pinaster* ; *Hylobius abietis*, L. ; *Magdalis violacea*, L., and *M. memnonia*, Gyll., which are associated with *P. notatus* ; and *Dioryctria splendidella*, Ratz. Trap-logs are used against *Myelophilus* and *Magdalis*. *Nygmia phaerrhoea*, Don. (*Euproctis chrysorrhoea*, auct.) is the chief pest of oaks, with the exception of *Quercus ilex*. *Otiorrhynchus cribricollis*, Gyll., attacks the twigs of *Eucalyptus*.

Bezares (E.). **Fauna entomológica de los pinabetares. Valle de Arán.** [The entomological Fauna of *Abies pectinata* in the Valle de Arán.]—*Rev. Biol. for. Limnol.*, i (A), no. 2, pp. 83–107, 14 figs. Madrid, 10th December 1929. (With a Summary in French.)

This is the first of a series of reports on the fauna of *Abies pectinata* in the Spanish Pyrenees, and records observations made in July 1929 in the valley of Arán. The chief insects found were *Ips* (*Tomicus*) *curvidens*, Germ., *Pissodes piceae*, Ill., *Acanthocinus reticulatus*, Razm., *Leptura sanguinolenta*, L., *Sirex gigas*, L., *S. spectrum*, L., and *Rhagium bifasciatum*, F. Notes on their bionomics are given. *I. curvidens* seems to be the most dangerous pest. Infested trees should be barked

in spring before June, when the larva penetrates into the wood. This will also destroy the larvae of *Pissodes* and *Acanthocinus*, which come next in importance, but to complete the work against *I. curvidens*, the branches and twigs of infested trees must be removed and burned.

VILLENEUVE (J.). **Notes diptérologiques.**—*Bull. Soc. Sci. Seine-et-Oise*, (2) x, no. 5, pp. 71–73. Versailles, 1929.

Notes are given on a number of Diptera, including *Zenillia* (*Exorista*) *mitis*, Mg., bred from *Pyrausta nubilalis*, Hb., near Paris.

C. G. B. **Parasites de** *C. pomonana.*—*Bull. Soc. Sci. Seine-et-Oise*, (2) x, no. 6, p. 79. Versailles, 1929.

The Ichneumonids, *Pimpla inquisitor*, Scop., and *Trichomma enecator*, Rossi, and the Braconid, *Ascogaster quadridentatus*, Wesm., are recorded, apparently for the first time, as parasitising *Cydia pomonella*, L. (*Carpocapsa pomonana*, Treitschke) in France.

KRAUSSE (A.). **Dachpappenbedeckung gegen Engerlinge.** [Roofing-paper Covers against Melolonthid Larvae.]—*Forstl. WSchr. Silva*, xvi, 1928, p. 240. (Abstract in *Neuheiten PflSchutzes*, 1929, no. 4, p. 113. Vienna, December 1929.)

It is suggested that sheets of roofing paper might be used to prevent *Melolontha* from ovipositing in soil in which valuable plants are grown, and that pieces of turf with the soil side turned upwards might attract ovipositing females.

BRANDT (—). **Allerhand Beobachtungen über Rüsselkäfer-und Maikäferschäden.** [Various Observations on Injury by Weevils and Cockchafers.]—*Forstl. WSchr. Silva*, xvi, 1928, pp. 350–351. (Abstract in *Neuheiten PflSchutzes*, 1929, no. 4, p. 114. Vienna, December 1929.)

To protect young pine stands threatened by *Hylobius abietis*, L., originating in fresh fellings, a belt, 300 ft wide, must be kept free from the weevil, half the belt being in the felled area, and the other half in the young pine stands.

Strawberry beds are favourite oviposition places during the flight-period of *Melolontha*. If the beds are covered with straw-mulch late in the autumn before the flight-year, the rain and snow press the straw into the soil and such places are always avoided by ovipositing females.

SCHIMITSCHEK (E.). **Rüsselkäfervertilgung.** [Weevil Destruction.]—*Wien. allg. Forst- u. JagdZtg.*, xlvi, 1928, p. 292. (Abstract in *Neuheiten PflSchutzes*, 1929 ,no. 4, pp. 114–115. Vienna, December 1929.)

Spruce bark dusted with arsenicals proved unattractive to *Hylobius abietis*, L., so that few individuals were killed, whereas undusted bark was heavily infested. Two pieces of spruce bark, placed with the inner surfaces together with a pine-twig sandwiched between them, form a good trap, from which the beetles can be collected. Two green posts should be placed near the bark-trap in order to attract oviposition, and afterwards burnt.

TEMPEL (W.). **Blattrandkäfer als Rosenschädlinge.** [*Sitona lineata* as a Pest of Roses.]—*Die kranke Pflanze*, vii, no. 1, pp. 8–9, 1 fig. Dresden, January 1930.

Sitona lineata, L., is recorded as attacking the edges of the leaves of climbing roses at Dresden.

MAAS (J.). **Naphthalin gegen Rote Spinne.** [Naphthalene against Red Spider.]—*Gartenwelt*, xxxiii, p. 305, 1929. (Abstract in *Zbl. Bakt.*, (2) lxxx, no. 1–7, p. 144. Jena, 22nd January 1930.)

Greenhouse fumigation with calcium cyanide against *Tetranychus telarius*, L., often injures the plants. Naphthalene proved quite satisfactory in a cucumber house, when scattered in dull weather at the rate of 1 lb. per 100 sq. ft. of floor-surface. The damp house was closed for 36 hours (two nights and one day), and the fumigation was repeated after a fortnight.

ZIMMERMANN (F.) & LINKE (W.). **Versuche mit Erdflohbekämpfungsmitteln im Hopfenbau.** [Tests with Insecticides against Flea-beetles in Hop Cultivation.]—*Landw. Fachpresse Tschechoslow.*, vi, pp. 180–181. Prague, 1928. **Der Erdflohbefall und die kühle Temperatur.** [Flea-beetle Infestation and cool Temperatures.]—*T.c.*, p. 198. (Abstract in *Zbl. Bakt.*, (2) lxxx, no. 1–7, p. 144. Jena, 22nd January 1930.)

Psylliodes attenuata, Koch, is the only flea-beetle known to infest hops in Bohemia, and it is not harmful every year. Calcium arsenate dust proved very effective against it, and a 2 per cent. solution of tobacco extract, though somewhat less so, was quite satisfactory.

ECKSTEIN (—). **Ein wichtig gewordener Schädling des Laubholzes:** *Hylecoetus dermestoides.* [*H. dermestoides*, a Pest of deciduous Trees that has become important.]—*Forstarchiv*, v, pp. 260–261, 3 figs., 1929. (Abstract in *Zbl. Bakt.*, (2) lxxx, no. 1–7, p. 146. Jena, 22nd January 1930.)

The four-day flight-period of the Lymexylonid, *Hylecoetus dermestoides*, L., occurs in April-June. The eggs are laid on felled trunks or fresh stumps of deciduous trees (rarely on conifers), and the larvae feed on fungi in the mines. Timber felled in winter should be quickly removed ; barking is useless.

SEITNER (M.). *Chortophila laricicola* **Karl, die Lärchenzapfen- und Samenfliege, und ihre Feinde : Parasiten und Räuber.** [*C. laricicola*, the Larch Cone and Seed Fly and its Parasites and Predators.] —*Zbl. ges. Forstwes.*, lv, pp. 153–167, 4 figs., 2 pls., 1929. (Abstract in *Zbl. Bakt.*, (2) lxxx, no. 1–7, p. 146. Jena, 22nd January 1930.)

The Anthomyiid, *Phorbia* (*Chortophila*) *laricicola*, Karl, oviposits in May-June on the scales of the young larch cones. The young larva either bores into the cone or makes its way beneath the scales, from which it emerges when mature and pupates in the ground-litter, the winter being passed in the pupal stage. One larva can destroy all the seeds in a cone, but some cones may contain as many as four, and the

seed crop is often destroyed almost completely. *C. laricicola* occurs throughout the Austrian Alpine region and in South Moravia. Its parasites included the Cynipid, *Seitneria austriaca*, Tavares, the Braconid, *Phaenocarpa seitneri*, Fahr. (which was the commonest), and the Ichneumonid, *Asyncrita rufipes*, FörST.

ZATTLER (—). **Bekämpfung der roten Spinne im Hopfenbau.** [Work against the Red Spider in Hop Cultivation.]—*Allg. Brau- u. Hopfenztg.*, lxix, p. 981, 1929. (Abstract in *Zbl. Bakt.*, (2) lxxx, no. 1–7, p. 149. Jena, 22nd January 1930.)

The red spider [*Tetranychus telarius*, L.] infesting hops may be controlled by a spray containing 1·5 per cent. soft soap and 0·5 per cent. tobacco extract. In order not to spoil the aroma of the flowers, this spray should not be applied after one-third of the flower development has been completed.

TSCHAEN (—). **Neue Wege zur Bekämpfung des Kiefernspanners.** [New Methods against *Bupalus piniarius*.]—*Deutsche Forstztg.*, xliv, pp. 660–663, 4 figs., 1929. (Abstract in *Zbl. Bakt.*, (2) lxxx, no. 1–7, p. 150. Jena, 22nd January 1930.)

Burning over the ground destroys the pupae of the pine moth [*Bupalus piniarius*, L.]. The tree trunks must have been previously covered with a solution of calcium chloride up to a height of 3 ft. Immediately the flight-period begins, the trees should be treated with an arsenical spray, such as 1 lb. lead arsenate paste in 8 gals. water.

VOELKEL (H.). **Zur Methode der Bekämpfung der Forstschädlinge durch Bestäubung vom Flugzeuge aus.** [A Contribution to the Method of Control of Forest Pests by dusting from an Aeroplane.] —*Forstwiss. Zbl.*, li, pp. 414–419, 1929. (Abstract in *Zbl. Bakt.*, (2) lxxx, no. 1–7, p. 151. Jena, 22nd January 1930.)

In dusting from the air against *Bupalus piniarius*, L., the whole forest should be given a thin coating of arsenical dust, at the rate of about 16–24 lb. to the acre, immediately the first larvae are observed. The dusting should be repeated to destroy larvae that hatch later on. In Germany about 34,120 acres were dusted by aeroplane against various forest pests in 1928.

BABCOCK (K. W.) & VANCE (A. M.). **The Corn Borer in Central Europe. A Review of Investigations from 1924 to 1927.**—*Tech. Bull. U.S. Dept. Agric.*, no. 135, 54 pp., 10 pls., 3 figs., 7 refs. Washington, D.C., November 1929.

A general summary is given of the investigations on *Pyrausta nubilalis*, Hb., carried out in Central Europe by the United States Department of Agriculture over the period 1924–27. The more detailed studies discussed were made principally in Hungary and north-eastern Jugoslavia. Cursory studies were also conducted in Austria, Germany, Poland, Rumania, Greece, and Czechoslovakia. The average dates of outstanding developments in the seasonal history are deduced from a comparison of the data secured during the 4 years' observations. Much of the information given concerning the number

of generations occurring annually, the extent and economic results of infestation, the crops attacked, other food-plants, natural enemies, and the part played by agricultural and environmental control factors has already been noticed [*R.A.E.*, A, xv, 247, 285, 456; xvi, 56, 273, 528] or will subsequently be dealt with in greater detail.

The following is taken from the conclusions arrived at from the data collected: The seasonal rhythm of the corn borer is to a certain extent persistent and is due to the formation of a physiological condition that forces the insect to develop a certain type of seasonal cycle. This condition is formed by the continued impress of a particular type of normal environment and persists after the impress of the environment is removed. There are apparently no reasons why the distribution of *P. nubilalis* should not extend to all points in the main maize-growing regions of the United States. The practice of clean culture following a programme which includes all possible means of reducing the number of borers is an essential feature of control. In areas where only one generation a year occurs, weeds and crops and other than maize may be heavily infested. In view of the widespread distribution and local effectiveness of certain parasites of *P. nubilalis* in Central Europe, it is hoped that parasites may be an effective auxiliary means of control in North America. No variety or type of maize was observed to be practically immune from attack. Severe losses in yield, occasioned by indirect injury, may occur in typical maize-growing centres. Such damage was particularly noticeable upon the plains of Hungary and Jugoslavia, where high winds similar to those prevailing in the maize belt of the United States occur in the latter part of the summer.

The elimination of highly susceptible varieties of maize and the observation of the most favourable date of planting appear to constitute two of the most promising control methods. In view of the fact that a change in the method of growing hops has eliminated *P. nubilalis* as an economic factor in the production of this crop in Central Europe, it is considered that radical changes in cultural practice may prove effective in the control of the borer on maize. The classification of localities according to the amount of damage expected, although not at present warranted by the available data, may come to be of assistance in allotting the funds necessary for keeping larval populations below the level at which they inflict commercial loss.

TRÄGÅRDH (I.). **Om tallbockens skadegörelse och bekämpände.** [On the Injury caused by the Pine Sawyer (*Monochamus sutor*, L.) and its Prevention.]—*Medd. Skogsförsöksanst.*, no. 25, pp. 171–228, 29 figs., 16 refs. Stockholm, 1929. (With a Summary in English.)

The author surveys, chiefly from the literature, some little-known features of the life-history of Longicorns, particularly as regards oviposition, larval tunnels, pupation, and emergence and feeding habits of the adults. In regard to oviposition he divides them into two groups: those that do or do not depend on the presence of bark for depositing their eggs. According to the position of the larval tunnels and pupal chambers he divides them into three groups: those making both larval tunnels and pupal chambers under the bark (*Rhagium*); those making larval tunnels under the bark and pupal chambers in the wood (*Tetropium*, *Callidium*); and those making larval tunnels partly in the bark, but mainly, like their pupal chambers, in the wood

(*Monochamus*). According to the feeding habits of the adults, he recognises four groups: those that feed on pollen and other parts of the flowers (LEPTURINI, some CERAMBYCINI and LAMIINI); those that feed on the green parts of plants, such as leaves and needles (*Saperda carcharias*, L., and *S. candida*, F.); those that feed on the bark of twigs and branches as well as on the stems and ribs of leaves (*Monochamus galloprovincialis*, Ol.); and those that feed on the bark of the trunks (*M. sutor*, L., and *Acanthocinus aedilis*, L.). Whether the Longicorns of the last group feed when gnawing slits for their eggs, or on emerging from the pupal chamber, investigation of the alimentary canals of both species mentioned, not hitherto known to consume bark, has shown it to be part of their regular diet. If feeding takes place from the exterior surface when the females oviposit, this habit may be utilised by dusting or spraying the timber to be protected with some poison.

Life-history studies of *Monochamus sutor*, L., on pine and spruce in Sweden indicate that trees exposed to the sun and preferably with thick bark are chosen for oviposition, the minimum number of eggs laid by one female being probably about 50. Observations after forest fires showed that no eggs will have been laid in trees with more than half of the crown still green in autumn. Only the scorched side of a tree will be attacked, and trunks scorched all round are much more heavily infested, the degree of infestation being generally proportionate to the degree of injury by fire. The maximum oviposition occurs at a height of 6½–13 ft. from the ground, so that the most valuable part of the trunk is most exposed to attack. The regular abundance of *M. sutor* after forest fires is partly accounted for by the fact that in Sweden such fires usually break out after a period of drought at the end of June or beginning of July, a time coinciding with its breeding season. The beetles are attracted from regions many miles distant to which the smell of fire is carried by the wind.

The egg funnel penetrates into the cambium, where the egg is laid. The newly-hatched larva excavates an irregular cavity without furrowing the surface, and later enters the wood. Its method of boring is described in detail. Numerous experiments were carried out to determine the period at which the larvae enter the wood. In one instance where a forest fire occurred on 6th July, some trunks cut and barked on 17th August showed numerous cavities under the bark, but no holes in the wood, so that in this case the removal of bark six weeks after the fire was adequate to destroy the larvae before they had entered the wood. In other instances, however, many larvae had already entered the wood. A closer investigation indicated that *M. sutor* in ovipositing starts with the largest and most severely scorched trees, and these should be first decorticated in order to prevent attack and subsequent injury. A comparison between timber cut and barked 2–3 weeks and 8 weeks respectively after a forest fire showed a reduction of 75 per cent. in the number of holes made by *M. sutor* in the earlier treated wood. Barking must, however, be very thorough, as the larvae are able to develop and penetrate into the wood if strips of the inner bark even 1 inch wide are left. In another locality the larvae did not enter the wood until between 22nd August and 1st September.

In view of the fact that it is often impossible to bark timber early enough to prevent the larvae from entering the wood, observations were made to determine how far they penetrate during the autumn, and to what depth it would be necessary, in later treatment, to remove the

wood to prevent further damage. In lumber cut and barked at the beginning of September about 50 per cent. of the burrows were as deep as 3–4·5 cm. [1¾ inches], and only 20 per cent. were deeper.

Spruce or pine trees felled and left throughout the summer exposed to the sun are invariably attacked, but the injury caused is immaterial in timber intended for pulp. Trees accidentally felled by storms sometimes suffer serious injury, though those left in the stands are not subject to oviposition. The covering of lumber left exposed to the sun with branches and twigs, though it does not entirely prevent oviposition, will retard the development of the larvae sufficiently to prevent their penetrating the wood, even if the trunks are not decorticated until the winter. After a forest fire, the young larvae may be effectually destroyed in the severely scorched trunks that are most subject to attack by submerging the logs after removing the bark in strips. Timber cut during the winter, floated during the spring and kept submerged until shipped is generally free from attack, unless some of the logs jam in rapids and are lifted above the water, when oviposition occasionally occurs. Even when stacked throughout the summer at the saw-mills, timber that has thus been submerged does not appear to be subject to infestation.

The possibilities of the introduction of *M. sutor* into other countries in timber exported from Sweden are discussed. Although its presence cannot be detected in its early stages without decortication, in view of the care exercised by Swedish lumbermen it is not likely that any infested timber will be exported. Moreover, the peculiar habits of *M. sutor* render breeding in timber yards impossible and establishment as a pest in other countries unlikely. Little danger exists of its introduction into New Zealand, where ideal conditions exist for its establishment and spread, since that country produces abundant timber and competes with Sweden in the Australian market. A description of the larva is given, and the characters distinguishing it from that of *Acanthocinus aedilis*, which is not injurious, are indicated.

[Golovyanko (Z.).] **Головянко (3.). The Cockchafer and cultivated Plants.** [*In Russian.*]—*Lesnoe Khozyaistvo* [*Forest Economy*], 1928, no. 7–8, pp. 84–92, 9 refs. Moscow, 1928. [Received 1930.]

Investigations of recent years have shown that there exists an inverse relation between the density of the infestation of the soil by *Melolontha hippocastani*, F., and the degree of exposure to light, the optimum conditions for the larvae being the comparatively dry and warm sandy soil of forests with sufficient shade. Felling results in a gradual disappearance of the larvae of *M. hippocastani* and its associate, *Serica brunnea*, L., while the bare area becomes infested with those of *Amphimallus solstitialis*, L., *Anisoplia segetum*, Hbst., *A. deserticola*, Fisch., *Anomala* and *Maladera* spp., *Polyphylla fullo*, L., and *Anoxia pilosa*, F., the last two species being the most injurious, although they spread very slowly owing to the inactivity of the females. In order to safeguard the cleared areas from infestation, they should be used immediately for the cultivation of crops, which will also prevent the formation of turf. Young pines grow very well in cleared areas in which the larvae of *M. hippocastani* have disappeared and those of *P. fullo* have not yet become numerous, but as soon as the crowns of the

trees form a canopy, the former species reinfests the soil. Conditions governing the resistance of the trees to infestation are discussed in detail. Observations indicated that it depends on the ability of the tree to form new roots in place of the injured ones; this proved impossible in a very dry sandy soil, whereas pines planted in a comparatively damp soil, with layers retaining moisture, always produced new roots to replace those destroyed by the larvae. The resistance of pines growing on such soil increases with the age of the tree. The author considers that trees are only killed by the larvae owing to lack of moisture or a too superficial penetration of the roots into the soil.

[Megalov (V.).] Мегалов (В.). **The Programme of Work on the Estimation of noxious Insects and the Damage caused by them.** [*In Russian.*]—8vo, 34 pp., 8 figs. Saratov, Inst. Izuchen. Zasukhi RSFSR. [Inst. Study Drought], 1929.

A general programme of work for entomological stations is outlined, including notes on the preparation of specimens of insects. A list of the chief pests of cultivated plants in Russia is given, classified according to the parts attacked. The technique of the quantitative estimation of the insects in their various stages and of the damage caused is indicated, and the methods applied in the analysis of infested individual field crops are discussed. A short list of Russian literature dealing with agricultural pests is appended.

Cleare, jr. (L. D.). **Entomological Division. Annual Report 1928.**—*Agric. J. Br. Guiana*, ii, no. 4, pp. 217–221. Georgetown, December 1929.

Most of the information contained in this report on the insect pests occurring in British Guiana in 1928 has already been noticed from other sources [*R.A.E.*, A, xvi, 652; xvii, 24, 25, 309]. As the result of the serious outbreak of *Brassolis sophorae*, L., that began in 1927, many of the coconut palms in Georgetown were denuded of foliage. An obligatory campaign of cleaning was organised in April and continued with a short interruption in June until the middle of August, and 1,300 palms were cleared of infestation at the cost of about 6*d.* a tree.

Destructive Insect and Pest Act. Regulation no. 4 (Foreign) 3rd Revision.—*Canada Dept. Agric.*, A.O.R. no. 8, suppl., 1 p. Ottawa, 17th February 1930.

This revision [*cf. R.A.E.*, A, xvii, 530] permits the introduction into Canada from the Hawaiian Islands of ginger root (*Zingiber*) and taro (*Colocasia*), if certified free from infestation by the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.]. The restrictions on the importation of plants and plant products from Florida are removed.

Essig (E. O.). **Plant Quarantine.**—*Science*, lxxi, no. 1840, pp. 350–353. New York, N.Y., 4th April 1930.

The importance is discussed of plant quarantines, which are held to be of great value in preventing invasions of insect pests.

Modification of the Rules and Regulations supplemental to Notice of Quarantine no. 68 (revised).—*U.S. Dept. Agric., P.Q.C.A.*, [Circular no.] 268, multigraph, 2 pp. Washington, D.C., 20th February 1930.

From 21st February 1930 West Florida is released from quarantine restrictions on account of the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] [*R.A.E.*, A, xvii, 661]. The fly has never been found in this part of the State.

Administrative Instructions. Sterilisation of Citrus Fruits under Mediterranean Fruit Fly Regulations.—*U.S. Dept. Agric., P.Q.C.A.*, [Circ. no.] 271, multigraph, 1 p. Washington, D.C., 4th March 1930.

An alternative method authorised for the sterilisation of citrus fruits against the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in Florida [*R.A.E.*, A, xvii, 662] consists in cooling until the approximate centre of the fruit reaches a temperature of 30–31° F., which must be maintained for 15 days.

Notice of Lifting of Asiatic Beetle and Asiatic Garden Beetle Quarantine.—*U.S. Dept. Agric., P.Q.C.A.*, Lifting Q. no. 66, 1 p. Washington, D.C., 20th February 1930.

It having been determined that injury to lawns and grass plots by *Anomala orientalis*, Waterh., and *Aserica castanea*, Arrow, can be effectively controlled, the Federal quarantine against these beetles [*R.A.E.*, A, xvii, 365] is raised as from 1st March 1930.

Leach (B. R.). **The Control of White Grubs in Lawns and Golf Courses.**—*Circ. New Jersey Dept. Agric.*, no. 163, 13 pp., 3 figs., 6 refs. Trenton, N.J., May 1929.

Lamellicorn larvae attacking turf in the United States have become increasingly important in recent years, since the introduction of *Popillia japonica*, Newm. (Japanese beetle), *Anomala orientalis*, Waterh. (Asiatic beetle) and *Aserica castanea*, Arrow (Asiatic garden beetle), which cause serious damage to lawns and golf courses wherever they have become established. Experimental work carried out from 1921 to 1928 has resulted in the recommendation of lead arsenate for the control of these pests. On lawns less than an acre in extent 5 lb. lead arsenate mixed with 1 bushel of moist screened sand or soil and broadcast over each 1,000 sq. ft. of turf will prevent injury for 3–4 years. Mowing, watering, etc., may be continued after treatment, but fertilisers containing sodium nitrate, superphosphate, potassium sulphate or potassium chloride should not be applied, as they react with lead arsenate and reduce its effectiveness. Other materials, such as well-rotted manure, ammonium sulphate, etc., may be used. On extensive areas, such as large lawns and the fairways of golf courses, 150 or 250 lb. lead arsenate per acre may be applied. The smaller dosage gives protection for two years and the larger one lasts for three or four. The poison may be applied by means of a so-called lime spreader, which consists of a feed box 6–8 ft. wide on wheels, with a

rotator inside to agitate the material and ensure even feeding to the spouts or holes in the bottom through which the mixture is discharged. The quantity of material per acre is graduated by the adjustment of a regulator. The filler for use in this type of machine must be dry and finely ground to prevent clogging. Finely sieved dry sand or soil is satisfactory if available. The treatment recommended for golf greens is the same as that for small lawns, but to prevent the layer of poisoned soil being gradually buried by the regular application of top-dressings, lead arsenate should be applied with each dressing at the rate of ½–1 lb. per 1,000 sq. ft. (depending on whether the dressing is heavy or light). Lead arsenate should not be applied to grasses such as *Poa annua* and *P. trivialis*, which are commonly grown in shady situations, or to heavily shaded turf.

SWEZY (O.) & SEVERIN (H. H. P.). **A Rickettsia-like Microorganism in *Eutettix tenellus* (Baker), the Carrier of Curly Top of Sugar Beets.**—*Phytopathology*, xx, no. 2, pp. 169–178, 2 figs., 9 refs. Lancaster, Pa., February 1930.

In investigations on *Eutettix tenella*, Baker, the vector of curly-top of sugar-beet, the authors found that the insect harbours two different organisms that show affinities with bacteria but have some of the characteristics of *Rickettsia*. They cannot be separated morphologically, but one is filterable and the other not, the former being found in infective insects, the latter in both infective and non-infective ones.

KNIGHT (H. H.). **An European Plant-bug (*Adelphocoris lineolatus* Goeze) found in Iowa (Hemip. : Miridae).**—*Ent. News*, xli, no. 1, pp. 4–6. Philadelphia, Pa., January 1930.

A few adults of *Adelphocoris lineolatus*, Goeze, were taken by the author at Ames, Iowa, in June 1929. This Capsid had not previously been found in the United States, but was recorded from Cape Breton Island in 1922. In Europe it occurs on a variety of plants of different families. Further investigations in July revealed it breeding in such large numbers in fields of lucerne and sweet clover that there is a possibility of its becoming a pest of these crops. Individuals have now been taken over an area of about 75 miles from the point where it was first observed, and many have been captured at electric lights.

The author suggests that it was introduced in the egg stage, probably about 3–5 years ago. Descriptions are given of the adults of both sexes and of the fifth instar nymph.

SPULER (A.). **Spraying Experiments for Codling Moth Control.**—*Bull. Washington Agric. Expt. Sta.*, no. 232, 70 pp., 9 figs., 23 refs. Pullman, Wash., March 1929.

An account is given of the control of the codling moth [*Cydia pomonella*, L.] in Washington, where experiments were carried out in 1928 in an endeavour to develop a spray programme that would be more efficient than the one hitherto in use and at the same time reduce to a minimum the amount of lead arsenate employed. The following is taken from the author's summary and conclusions : Treatments were compared by pairing trees sprayed with various materials with other trees sprayed with lead arsenate, the total number of larval entries on

all fruit on the trees being used as a basis. Lead arsenate used at the rate of 4 lb. to 100 U.S. gals. was more effective in protecting fruit from larval injury than when used at the standard rate of 2 lb. to 100 U.S. gals., but the difference was not sufficient in orchards of light to normal infestation to warrant the use of the heavier concentration. The insecticidal value of lead arsenate may be increased by the addition of materials that increase its adhesive properties, or reduced by the admixture of those that facilitate removal of residues. Casein-lime spreaders did not increase the effect of lead arsenate, but the addition of fish-oil secures better adherence to fruit and foliage and increased protection to fruit. Magnesium, calcium, aluminium and manganese arsenates did not give results equal to those from lead arsenate, and scorching of fruit and foliage resulted where calcium and manganese arsenates were used. Sodium and barium fluosilicates, even when combined with fish-oil, proved inferior to lead arsenate. Oil sprays act as ovicides and to some extent as larvicides, but when used alone failed to control *C. pomonella*. The injury caused to fruit and foliage by repeated applications of these oils, particularly those of high viscosity, indicates that they should not be applied more than 2 or 3 times during the season. Nicotine sulphate acts as an ovicide and larvicide, but soon loses its insecticidal value and cannot be used alone unless applied at frequent intervals. The addition of 1 lb. aluminium sulphate to 100 U.S. gals. nicotine sulphate, 1–800, prolonged its insecticidal value, but produced russeting or blotching. Nicotine oleate was not so effective as nicotine sulphate. A combination of oil and nicotine proved equal to or better than the standard lead arsenate spray in four tests. This spray, which is also very effective against other pests such as mites, leafhoppers and Aphids [especially *Eriosoma lanigerum*, Hausm.], may therefore be used as a substitute for some of the lead arsenate sprays when it will be effective in controlling these pests. The number of applications should, however, be limited to 2 or 3 on account of the high cost of the spray and the possibility of injury. Mineral oil combined with lead arsenate at the rate of ½ lb. to 100 U.S. gals. water was equivalent in insecticidal value to 4 times that amount of lead arsenate used alone. Oil also acts as an adhesive for lead arsenate and makes the arsenical more effective, but causes the deposit of a larger amount of arsenical residue on the fruit and increases the difficulty of removing spray residues. The combination of light oil and lead arsenate did not give good results, probably because the oil caused the particles of the particular brand of lead arsenate used to flocculate and settle to the bottom. Small amounts of oil added to the spray did not produce this effect. A combination of standard lead arsenate spray with nicotine sulphate, 1–800, gave results similar to lead arsenate alone. The efficiency of lead arsenate was improved when used in combination with an alcohol extract of pyrethrum. Combination sprays, which are more costly than lead arsenate and should not therefore be substituted for it in all cases, may be used to increase its efficiency without increasing the problem of spray residue removal, by reducing the concentration of lead arsenate or eliminating some of the lead arsenate applications.

None of the spray treatments discussed proved 100 per cent. effective, and the degree of control obtained depends largely on the number of larvae that must be destroyed in order to protect the fruit. The survival of 10 per cent. in a severely infested orchard may produce considerable injury, whereas in orchards only lightly infested it

would be insignificant. It is possible by means of supplementary treatments, such as scraping and banding the trees and the use of moth traps, if they are continued over a period of two years, to reduce the number of larvae to a point where spray treatment alone will prove highly efficient the following year. Maximum results can only be secured by co-operation among all the growers in a district. The success of spray treatment depends on effective timing, and must be accompanied by proper horticultural practices, such as pruning and tree-spacing, and the use of efficient equipment.

NICHOLS (E. R.). **Termites of Southern California.**—*J. Ent. Zool.*, xxi, no. 4, p. 123. Claremont, Cal., December 1929.

Termites are very prevalent in southern California. The three common species are *Termopsis angusticollis*, Hagen, which requires considerable moisture and is found in tree crotches and rotten logs, and *Calotermes minor*, Hagen, and *Reticulitermes hesperus*, Banks, which are important pests in timber, etc. *R. hesperus* is a subterranean species, whereas *C. minor* is not. The remaining eight species are restricted to desert and semi-desert areas and are of little importance owing to the lack of vegetation and sparse population of these regions.

WHITCOMB (W. D.). **The Plum Curculio in Apples in Massachusetts.**—*Bull. Massachusetts Agric. Expt. Sta.*, no. 249, pp. 26–52, 8 figs., 11 refs. Amherst, Mass., March 1929.

This bulletin is the result of some years' observations on *Conotrachelus nenuphar*, Hbst. (plum curculio) in Massachusetts, where it is by far the most important pest of apples, early maturing varieties being particularly susceptible to injury. The life-history and habits are described in detail. There is only one generation annually, about 55 days being necessary for development from egg to adult [*cf. R.A.E.*, A, xvii, 525], and the beetles living approximately one year, from August to August. One pair of beetles in captivity made an average of 236 feeding punctures, from 64 to 83 per cent. of the total being for feeding purposes. The seasonal history on apples is shown in a diagram. Feeding by overwintering beetles begins and reaches its maximum about the same time as oviposition and continues to a decreasing extent until the cold weather. Larvae are leaving the fruit from the end of June to the beginning of September. During the winter from 60 to 75 per cent. of the beetles die. Larvae and pupae may be killed by exposure to hot sun and by baking and packing of the soil round the pupal cells. A few adults are killed by birds or predatory insects; only one parasite, tentatively determined as *Triaspis curculionis*, Fitch, has been observed, and none of these enemies makes any appreciable difference to the numbers. The burning of leaves, brush and woods in which the adults spend the winter reduces the numbers considerably, but the most effective measure is the collection of dropped apples within 10 days and destruction of the larvae in them by burying with quicklime, boiling, burning or feeding to stock. Cross cultivation close to the tree trunks with an extension disk harrow may kill many pupae if practised between 20th July and 1st August. In the laboratory a ½ per cent. solution of carbon bisulphide emulsion applied at the rate

of 3 U.S. pints to each square foot of soil killed 99·5 per cent. of larvae and pupae. With a normal crop of fruit, and when the number of insects averages less than 25 to each tree, thorough spraying should give adequate control. The most important sprays are the calyx spray, another 7 days later and a third 3 weeks after the calyx spray, preferably using 2 lb. lead arsenate to each 50 U.S. gals. spray, with 4 liquid oz. fish-oil to each lb. of poison (regardless of the dilution) or 1 gal. molasses to each 100 gals. spray as an adhesive. Dusting seemed rather less effective than spraying.

FERNALD (H. T.) & others. **Department of Entomology.**—*Bull. Massachusetts Agric. Expt. Sta.*, no. 247 (Bienn. Rep. 1927–28), pp. 317–319. Amherst, Mass., February 1929.

Brief notes are given by various authors on a number of injurious insects occurring in Massachusetts during 1927 and 1928, the following being by W. D. Whitcomb. In experiments against garden cutworms, baits consisting of a mixture of 25 lb. bran, 1 lb. Paris green, 1 U.S. qt. cheap molasses, and 2 U.S. gals. water gave effective control. Applications should be repeated at intervals of about 10 days, to kill cutworms migrating into the gardens from outside. Against the plum curculio [*Conotrachelus nenuphar*, Hbst.] on apple [see preceding paper], calcium arsenate and sodium fluosilicate were effective, but liable to injure the fruit and foliage. As regards eastern Massachusetts, it was found that the apple maggot [*Rhagoletis pomonella*, Walsh], during a period of three years, did not emerge in sufficient numbers to justify spraying until 15th July. It was also found that a spray applied three weeks after the calyx spray is more effective against *C. nenuphar* and the codling moth [*Cydia pomonella*, L.] than was previously realised.

HARTMAN (H.), CHILDS (L.) & ROBINSON (R. H.). **The Occurrence and Prevention of Calyx Injury in Apples from the Hood River Valley.**—*Bull. Oregon Agric. Expt. Sta.*, no. 242, 24 pp., 8 figs. Corvallis, Ore., May 1929.

Apples from the Pacific northwest are very subject to a peculiar form of calyx injury that is chiefly attributable to arsenical treatment and is most severe in fruit that has been exposed to wet weather after picking. Although most severe in heavily sprayed fruit, it sometimes occurs in apples that have been only lightly sprayed, and is frequently followed by decay due to moulds. The present studies have shown that acid liberated by the apple itself may contribute to the solubility of arsenic compounds in the calices. The injury is generally more serious in fruit kept in ordinary storage than in that in cold storage. Sometimes it is attributable to the washing process, the washing compounds or prolonged exposure to moisture rendering the arsenic soluble. Much of the calyx injury attributed in past years to washing, however, seems to have occurred in the field prior to the washing treatment. Precautions against calyx injury include keeping the fruit dry after picking ; gathering the fruit as soon as it is sufficiently ripe ; mixing hydrated lime or Bordeaux mixture with the sprays ; washing the fruit as soon as possible after picking ; changing the washing solutions frequently (each day with tanks of 150 to 250 U.S.

gallon capacity, that is, after 800 to 1,200 boxes of fruit have been washed) ; using hydrated lime (say, 1 to $1\frac{1}{2}$ lb. to each 100 U.S. gals. of water) in the rinse bath ; and keeping the fruit dry after washing.

LYLE (C.). **Controlling Plant Lice.**—*Quart. Bull. St. Plant Bd Mississippi*, ix, no. 2, pp. 4–8, 2 figs. A. & M. College, Miss., July 1929.

Directions are given regarding the methods for controlling Aphids on turnips, cotton and pecans by spraying or dusting with nicotine sulphate, and a home-made mixer for making the dust is described.

BECKWITH (C. S.). **The Blossom Worm, a Cranberry Pest.**—*J. N. Y. Ent. Soc.*, xxxvii, no. 4, pp. 409–416, 1 fig. New York, N.Y., December 1929.

Epiglaea apiata, Grote, is a serious pest of cranberry in New Jersey. Since the larva feeds at night, it has often escaped notice, and possibly the injury done by it has been attributed to other causes. It is of more importance on account of the severity and suddenness of its attack, causing the destruction of the whole crop, than because of its presence on all bogs every year. After an outbreak, a control measure is usually applied, and the moth does not appear again for several years. It is a minor pest of cranberry in Massachusetts, but is not recorded from any other cranberry regions. The adults have been collected throughout the central States, but the insect is not of economic importance on other crops, and nothing is known of its feeding habits except on cranberry. The larvae attack the leaves and sometimes cut off the new shoots and blossoms. Ten larvae in cages destroyed about 100 blossoms each in 3 weeks. Some damage is also done to the fruit. The adults appear in September and October and lay their eggs singly on dead leaves or twigs on the ground. In the laboratory each female laid 100–200. Hibernation occurs in the egg stage, the larvae hatching in April-June.

When an infestation is observed, flooding is the simplest method of control, a 24-hour reflow between 5th and 10th June being sufficient to kill the larvae. After 10th June, however, the blossoms are too far advanced to survive prolonged submergence. An alternative successful measure is spraying with lead arsenate. A soap spray should not be used either before or after the lead arsenate, or the plants will be scorched. Various birds, especially the red-winged blackbird, destroy large numbers of the larvae, and also serve to indicate an infestation by their activity on the bog. The larvae are parasitised by *Sagaritis oxylus*, Cress., *Euplectrus bicolor*, Swed., *Rhogas* sp., and a Tachinid.

BECKWITH (C. S.) & HUTTON (S. B.). **Life History Notes on some Leafhoppers that occur on New Jersey Cranberry Bogs.**—*J. N. Y. Ent. Soc.*, xxxvii, no. 4, pp. 425–427. New York, N.Y., December 1929.

The commonest leafhoppers on cranberry bogs in New Jersey are *Euscelis striatulus*, Fall., *Platymetopius magdalensis*, Prov., and *Thamnotettix smithi*, Van D. [*P. magdalensis* is apparently the insect

previously recorded as *P. frontalis*, Van D. (*R.A.E.*, A, xvii, 30, 672).] *Cicadula sexnotata*, Fall., is also common; adults were found in May and June, which indicates that overwintering occurs in this stage, and were present throughout the summer, but nymphs were taken only in July and August. It is believed to be a grass-feeder. Other species found were *Gypona striata*, Burm., which has probably two broods a year, *Thamnotettix nigrifrons*, Forbes, which occurs on grass plots in the bogs and dies if confined to cranberry for food, *Empoasca fabae*, Harr. (*mali*, LeB.), *Thamnotettix melanogaster*, Prov., *Chlorotettix viridius*, Van D., *Platymetopius hyalinus*, Osborn, *Parabolocratus viridis*, Uhler, and *Agallia constricta*, Van D.

McGovran (E. R.). **Increasing the Effectiveness of the Nicotine Insecticidal Unit Charge.**—*J. N. Y. Ent. Soc.*, xxxvii, no. 4, pp. 513–531, 1 fig., 17 refs. New York, N.Y., December 1929.

To determine methods of increasing the insecticidal efficiency of nicotine in an aqueous solution, the author made a study of the interfacial tension between the solution and the integument of insects and of the penetration of the breathing system by aqueous solutions of various surface tensions and various interfacial tensions. He found that distilled water, or distilled water carrying nicotine extract, having a surface tension of 40 or more dynes per cm., did not penetrate into the tracheae of the honey bee, even though the integument was thoroughly wetted. A reduction of the interfacial tension between the solutions and the integument and of surface tension sufficient to permit rapid covering of the integument with a thin layer, enabled the solution to penetrate the breathing system of the bee. Incorporation of sodium oleate soap in amounts varying from 0·2 to 2 per cent. actual soap so reduced the interfacial and surface tensions as to permit this to occur. Sodium oleate soap, unit for unit, was more efficient in accomplishing these reductions than fish-oil soap, and either was more efficient than any other substance with which the author worked. Free nicotine was a more effective agent against the cabbage Aphid [*Brevicoryne brassicae*, L.] for use with the above conditioned aqueous solution than nicotine sulphate. The size of the lethal charge of nicotine for destruction of the cabbage and green apple Aphids [*Aphis pomi*, DeG.] was very greatly reduced when incorporated in a soap solution. When sodium oleate, which is cheap, is used at a strength as great as 0·5 per cent. the amount of nicotine necessary to kill Aphids at summer temperatures is very small.

Poos (F. W.). **Leafhopper injury to Legumes** [Abstract].—*J. Wash. Acad. Sci.*, xx, no. 6, pp. 116–117. Baltimore, Md., 19th March 1930.

Twenty of the 30 species of leafhoppers occurring on forage crops in Virginia have been tested for the infective principle of the disease-like injury found on such crops [*cf.* *R.A.E.*, A, xvii, 375]. *Empoasca fabae*, Harr., and some of the new species of this genus are the only ones in which no individuals have been found that are free from the infection. The injury has not been found to be systemic. The infectious principle was inherited through six generations with no apparent loss of virulence. The degree of injury to a plant is more or less directly proportional to the number of leafhoppers placed on the plant. If the insects are

removed before the plant is too seriously injured, recovery follows. Controlled experiments showed the average loss in price of lucerne infested with *E. fabae* to be 33 per cent. Preliminary work indicates that control will be largely ecological, in that a rearrangement of certain crops may be advisable. A better use of existing varieties and the further development of varieties that best lend themselves to the situation should have due consideration.

CROSBY (C. R.), MILLS (W. D.) & BLAUVELT (W. E.). **Protecting Orchard Crops from Diseases and Insects.**—*Bull. Cornell Univ. Agric. Expt. Sta.*, no. 498, 80 pp., 19 figs. Ithaca, N.Y., December 1929.

Brief accounts are given of the principal diseases, insects and mites affecting fruit trees in New York, with recommendations for their control, including a discussion of the sprays and dusts employed and schedules for their application to the various trees.

DOZIER (H. L.), BUTLER (H. G.) & WILLIAMS (L. L.). **Department of Entomology** [Annual Report, 1928–29.].—*Bull. Delaware Agric. Expt. Sta.*, no. 162, pp. 29–43. Newark, Del., November 1929.

In the standard early sprays for apple, peach and grapes, "choice light pressed" Menhaden fish-oil [*R.A.E.*, A, xvii, 375] is now being commonly used as an adhesive and is found to give excellent results without damage to the foliage. During studies of *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth), it was found that many of the "stings" on the sides of the apples were the work of *C.* (*Laspeyresia*) *molesta*, Busck (oriental peach moth); this was particularly the case with late varieties, and it seems probable that the apples are attacked after the peach crop is gathered. Hymenopterous parasites reared from *C. pomonella* were *Ascogaster carpocapsae*, Vier., which seems to be the most important in Delaware, and *Phanerotoma tibialis*, Hald., both of which oviposit in the eggs and emerge from the mature larva after it has constructed its cocoon. *Aenoplex carpocapsae*, Cushm., and *Phytodietus burgessi*, Cress., were also reared from cocoons obtained from old picking baskets. The larvae of the Telephorid, *Chauliognathus marginatus*, F., were found in large numbers beneath codling moth bands on apple trees and among dropped apples on the ground and in clusters of ripe grapes on vines; they readily devoured larvae of *C. pomonella* and of the grape-berry moth [*Polychrosis viteana*, Clem.] in various stages.

The leafhopper, *Erythroneura vitis*, Harr., was a serious pest of Virginia creeper (*Parthenocissus quinquefolia*) and Boston ivy (*P. tricuspidata*); large numbers of its Mymarid egg parasite, *Paranagrus* sp., have been reared. Sycamore trees [*Platanus occidentalis*] have had their leaves discoloured and been partly defoliated by *E. maculata*, Gill., and by the sycamore lacebug, *Corythuca ciliata*, Say. Studies of the plum curculio [*Conotrachelus nenuphar*, Hbst.] were continued [*R.A.E.*, A, xvii, 389], and the seasonal history in different parts of Delaware is described. Apricots attracted the earliest weevils. Mature larvae from apples yielded the Mymarid egg parasite, *Anaphoidea conotracheli*, Gir.

Observations on *Polychrosis viteana* in 1928 [*R.A.E.*, A, xvii, 373] showed that a partial third generation of larvae occurred in that year;

those leaving the grapes after 3rd September overwintered as pupae, emerging as adults in the spring of 1929 in outdoor cages. The maximum emergence in 1929 occurred during the last 4 days in May. The moths remain inactive when the temperature is below 60° F. The dates of oviposition of these overwintering generations are shown in a table. During July, parasites were obtained, of which *Microdus* (*Bassus*) *annulipes*, Cress., was the most abundant, *Glypta mutica*, Cushm., *Angitia* (*Dioctes*) *obliterata*, Cress., and *Microbracon* sp. being less numerous. The first adults of *P. viteana* emerged from material kept through the winter in the insectary and in an outdoor screened cage on 25th April, and the last on 1st July. The first eggs were obtained on 13th May, the average incubation period being 3·9 days. The first larvae to mature left the berries on 23rd June for pupation, the larval period averaging 16·6 days. Unsprayed vineyards and neglected vines in gardens were heavily infested in 1929. There was very little evidence of parasitism of the first generation, but many eggs of the second were attacked by *Trichogramma minutum*, Riley.

The seasonal history of *Cydia molesta* in the laboratory is recorded. The eggs of the 4th generation hatched from 13th September to 24th October, and as there were no peaches available for food, the larvae were reared on apples. The average feeding period of these larvae was 42·36 days, this being nearly four times as long as that of the third generation reared earlier and at higher temperatures on peaches.

Driggers (B. F.). **Notes on the Life History and Habits of the Blueberry Stem Borer,** *Oberea myops* **Hald., on cultivated Blueberries.**—*J. N. Y. Ent. Soc.*, xxxvii, no. 1, pp. 67–73, 1 pl., 6 refs. New York, N.Y., March 1929.

The Lamiid, *Oberea myops*, Hald., is a pest of cultivated blueberry [*Vaccinium corymbosum*] in New Jersey. It appears to require three years to complete its life-cycle in the laboratory, though in the field it may possibly need only two. The adults occur from June to August, and the females appear to lay their eggs at night, girdling the twigs in two places about half an inch apart. The eggs probably hatch in 10–14 days, and the larvae bore first into the dead or dying part of the stem, and then into the living stem, in which they hibernate, continuing their tunnels in the following spring. After the second, or possibly the third, winter, they pupate in April or May. An unidentified Hymenopterous parasite emerged from 5 larvae only. The best control is to cut out infested shoots below the egg or larva. Such prunings may be left on the ground, as the larvae are unable to crawl back to the plant. Later on a piece of wire passed down any infested twigs that have been overlooked will kill the larvae. These measures should be carried out each year on account of reinfestation from wild blueberry and other closely related plants.

Jones (C. R.). **Ants and their Relation to Aphids.**—*Bull. Colorado Agric. Expt. Sta.*, no. 341, 96 pp., 385 refs. Fort Collins, Colo., February 1929.

The author has made a detailed study of the interrelations between ants and Aphids in Colorado, where he observed 50 species of the genus *Aphis* attended by 89 genera including 253 species of ants, as well

as many species of *Lachnus*, *Chaitophorus* and *Macrosiphum* with their attendant species. Lists are given of the ants showing the Aphids attended by them, of the Aphids with their ant attendants, and of the ants associating together in Aphid colonies.

LIST (G. M.). **The Sulphide Sulphur Content as a Basis for diluting Lime-sulphur for Spraying.** —*Bull. Colorado Agric. Expt. Sta.*, no. 352, 14 pp., 6 refs. Fort Collins, Colo., May 1929.

The following is the author's summary: All experimental data indicate that the insecticidal value of lime-sulphur is largely, if not wholly, due to the ability of the calcium polysulphides in it to take up large amounts of oxygen. The Baumé hydrometer test is not always an accurate method of measuring the amount of polysulphides in a solution. The presence of other soluble compounds affect the Baumé reading. The iodine test [the technique of which is outlined] for the sulphide sulphur seems to be more accurate than the Baumé reading. The ratio of the sulphide sulphur content of samples tested to their Baumé reading varied from ·604 to ·985. The ratio was higher in commercial samples than in home made. The effective amount of sulphide sulphur in the dilute spray seems to be 3·35 per cent. for San José scale [*Aspidiotus perniciosus*, Comst.], 2·55 per cent. for blister mite [*Eriophyes pyri*, Pgst.] and ·75 per cent. for summer spraying. The commercial samples, with the exception of two, when diluted according to the standard Baumé dilution tables, carried the specified percentages of sulphide sulphur. Some carried more than these percentages. The samples of home-made material carried from 68 to 88 per cent. of the specified amounts. The error in diluting home-made lime-sulphurs by the Baumé tables appears to be about 25 per cent. when sludge is not included. The presence of the sludge increases the error by another 5 per cent. The iodine test overestimates the sulphide sulphur content of dry lime-sulphurs. These materials, when diluted according to their sulphide sulphur content, become unpractical as insecticides [*cf. R.A.E.*, A, xiv, 168].

HOCKENYOS (G. I.). **Triethanolamine Oleate for Oil Sprays.**—*Indust. Engng. Chem.*, xxi, no. 7, pp. 647–648, 5 refs. Easton, Pa., July 1929.

The recent rapid development in the use of oil emulsions for insect control is reviewed from the literature [*R.A.E.*, A, xv, 625; xvi, 520; xvii, 75; xviii, 161], and an account is given of experiments carried out with commercial triethanolamine, a proprietary product containing approximately 70–75 per cent. triethanolamine, 20–25 per cent. diethanolamine and 0–5 per cent. monoethanolamine, which boils at approximately 277° C. and 150 mm.

The following are the author's conclusions: These experiments indicate that an excellent miscible oil may be made by boiling 5 parts of oleic acid with 6 parts of triethanolamine and adding 15 parts of free oleic acid and 5 parts of alcohol. This may then be dissolved in up to 40 parts of light or 100 parts of heavy paraffin oil. Preliminary experiments show no injury to plants other than the oily gloss which usually results from oil sprays. Good kills on mealybug and red spider resulted both with oil emulsion alone and with oil emulsions having

paradichlorobenzene or carbon tetrachloride dissolved in the oil. The only plant injury was due to excessive dosage of the light flushing oil, which is not so highly refined as the other two oils.

The most promising method of using the very light oils seems to be to make a solution of 3 parts of triethanolamine, 4 parts of oleic acid, 6 parts of carbon tetrachloride and 30 parts of oil. Such a solution is uniform though rather cloudy. It does not settle out or separate for several days, and although not miscible in water, it is very easily emulsified.

If these materials are to be made on a commercial basis they should have their acid and alkali values checked on each shipment.

RYAN (H. J.). [**Insect Pests in Los Angeles County.**]—*Mon. Bull. Dept. Agric. California*, xix, no. 1, pp. 68–69. Sacramento, Cal., January 1930.

The dictyospermum scale [*Chrysomphalus dictyospermi*, Morg.], which in Florida is a serious pest of *Citrus* and avocado, but had previously been taken in Los Angeles County only in greenhouses or extremely sheltered places, particularly on *Kentia* palms, has been found on 30 properties in the city of Los Angeles, infesting avocado growing in the open. There are within the city at least 70,000 palms (*Phoenix canariensis*) that may be considered potential food-plants. As a result of a survey of the distribution of *Otiorrhynchus* (*Brachyrrhinus*) *cribricollis*, Gyll., in Los Angeles County [*cf. R.A.E.*, A, xviii, 171], 19 infestations have been discovered. It is intended to breed ten million individuals of *Cryptolaemus* [*montrouzieri*, Muls.] for the control of the mealybug [*Pseudococcus gahani*, Green]. This output will require 2,000 sacks of potatoes (on the sprouts of which the host is reared), costing about £1,400.

BALDUF (W. V.). **The Life History of** *Achatodes zeae* **Harris (Lepidoptera : Noctuidae).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 9, pp. 169–177, 1 fig., 5 refs. Washington, D.C., December 1929.

A detailed account is given of the life-history of *Achatodes zeae*, Harr. (spindle worm), based chiefly on studies conducted in Ohio and Illinois during 1927 and 1928. Elder (*Sambucus*) is the preferred food-plant, but occasional and moderate injury to maize, dahlia and perhaps other thick-stemmed plants has been observed for the past 50 years.

All stages of this Noctuid are described. One generation occurs in a year, hibernation taking place in the egg stage. Almost fully grown larvae were found on 24th May in new shoots of elder varying between one and two feet in height, and their size indicated that the plant is infested by the larvae as soon as it sends out the shoots. The majority entered shoots arising from the ground. Usually each stem contains only one larva, many stems being uninhabited; in more serious infestations, however, as many as five larvae may occur in a stem. They feed on the pith, and maturity is usually reached in June or early July before it becomes white and tough. The pupal period, which varied according to climatic conditions from 18 to 36 days, was passed in stems other than those in which the larvae had fed, or in neighbouring weeds. Without exception dead stems were chosen.

The process of oviposition is described. The eggs are deposited in crevices in the bark, the females beginning to oviposit on the second

night after emergence ; at least 500 may be laid by one female. Eggs kept in cages in the open from July 1928 began to hatch early in April 1929 ; under natural conditions they would probably begin to hatch about a month later.

Swenk (M. H.). **Codling Moth Investigations in Nebraska.**—*Rep. Nebraska Hort. Soc. 1929*, pp. 31–49, 3 refs. Lincoln, Neb. [?1930].

This is a detailed account of the seasonal history of the codling moth [*Cydia pomonella*, L.] in Nebraska, based chiefly on studies conducted during 1928. Its activities and rate of development often vary from season to season in accordance with weather conditions, and much of the recent failure to obtain satisfactory control has been due to spraying schedules being based either on calendar dates or on development of flowers or fruits on the trees. It is evident that satisfactory control must depend on a knowledge of the brood development of the moth in any given season, and it is hoped by accumulating data over a number of years to shed some light on the fundamental causes of the variations in its life-history. Previous work is briefly reviewed, and it is concluded that two generations and a partial third normally occur in the State during the year, the third generation only being of economic importance in hot dry years.

Division of Entomology.—*48th Ann. Rep. New York Agric. Expt. Sta. 1928–29*, pp. 52–60. Geneva, N.Y., 1930.

Some of the information given in this report has already been noticed [*R.A.E.*, A, xvii, 269, 270, 367, 452, 726 ; xviii, 114]. In continued investigations on the pear psylla [*Psylla pyricola*, Först.] cold-mix lubricating oil emulsions and various commercial oil preparations proved very effective in reducing the number of adults and in rendering the trees uncongenial to them, but some grades of oil caused marked injury when applied over a number of years. The use of oil sprays is therefore recommended for not more than two successive seasons, after which nicotine sprays should be substituted for a season or two. The oil treatment may then be used again with comparative safety for one or two years. The majority of the eggs and young nymphs are killed by the residual effects of the oil, many of them dying one or two months after treatment. Recent studies of the addition of activators to nicotine sprays [xvii, 512, 714] indicate that by the use of such materials the amount of nicotine can be reduced at a considerable saving of cost.

Work in connection with pests of canning crops [xvi, 641] included studies of the seed corn maggot [*Phorbia cilicrura*, Rond.], carried out with a view to determining the insecticidal efficiency of various chemicals against the larvae and the influence of various treatments on the germination of peas, beans and maize.

The growing of dwarf rape as a cover crop in vineyards infested by cutworms, several species of which have recently developed climbing habits, and allowing it to remain under the vines in the spring until they have pupated, seems likely to prove a cheap and effective method of control. The chief insect pests of potato in 1928 were the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] and the second brood of flea-beetles [*Epitrix cucumeris*, Harr.], which were, however, easy

to control. Injury to foliage from blight was very evident where copper sulphate applications had been suspended in favour of nicotine dusts applied in anticipation of Aphid injury. Plants regularly treated with copper gave the highest yields, those sprayed averaging higher yields than those dusted. Plants receiving an alternative application of nicotine dust for Aphids had their yields invariably reduced. Preliminary experiments in planting dates showed increased yields in conjunction with early plantings. The necessity for treatment against injury from leafhoppers, which occurs during the last month of foliage development, is thus obviated. *Phorbia* (*Hylemyia*) *brassicae*, Bch. (cabbage maggot) was the most serious pest of cauliflower seed-beds, oviposition extending over 6 weeks in consequence of cool weather in May and June and necessitating additional treatment to avoid injury. The best results were secured with mercury bichloride solutions, 1–1,200. *Myzus persicae*, Sulz., was destroyed by disease on potatoes at the stage in development when migration to cauliflower seed-beds might have been expected. From observations during the past six years it appears that infestation of the seed-bed by Aphids and thrips follows that on potatoes if conditions are favourable, cauliflowers furnishing a fresh breeding ground for immigrants leaving overcrowded conditions on potato foliage.

Cowan (F. T.). **Life History, Habits and Control of the Mormon Cricket.**—*Tech. Bull. U.S. Dept. Agric.*, no. 161, 28 pp., 24 figs., 8 refs. Washington, D.C., December 1929.

This account of the bionomics and control of *Anabrus simplex*, Hald., is based on experimental work carried on in Wyoming by F. W. Boyd in 1923 and 1924 and by the author in western Montana in 1926 and 1927. Details are given concerning the history, geographical distribution, habitat and economic importance of this Tettigoniid, which naturally inhabits mountainous country but migrates from time to time to cultivated valleys, where it causes serious damage to crops, the region within which it occurs in the United States extending from Texas to Minnesota. It reaches the adult stage early in summer, and mating and oviposition follow 10–14 days later. The eggs are laid in summer and early autumn and hatch the following spring. The rate of oviposition, which occurs at any time of the day and in any soil, is not known, but it is certain that the number of eggs laid by one female varies considerably. From laboratory observations it is concluded that in nature one female lays about 150 eggs. Between the egg and the adult there are 7 nymphal stages, lasting in all 40–68 days in the laboratory at a temperature of 70–80° F., and 75–90 days in nature. All stages are described. It has not yet been possible to determine the duration of the life of the adult, but although the insect is hardy and frequently makes good use of shelter as a protection against cold, its pronounced cannibal habits and the number of its predatory enemies reduce the likelihood of longevity. A list is given of the natural enemies of *A. simplex*, the most important of which are birds and certain rodents. Garden crops of all kinds, fruits such as gooseberries, currants and apples, and practically all field crops are subject to attack, as well as a large number of uncultivated plants, a list of which is given. The grasshoppers are almost continually in motion from the time they hatch in the spring until they disappear in the autumn, a band once in motion travelling in a straight line irrespective of obstacles. The

general direction of the migrations varies from one locality to another, but appears to remain fairly constant in a given locality from year to year. No explanation of the choice of direction has yet been found. The information given concerning the insect enemies of *A. simplex* and the measures employed against it has already been noticed [*R.A.E.*, A, xvii, 479].

SWAINE (J. M.). **Fighting Insect Pests from the Air.**—*Canada*, xcvi, no. 1257, p. 203, 2 figs. London, 15th February 1930.

Serious injury to forests in Canada has been caused for the past two generations by a number of leaf-eating insects. Among those of primary importance are the spruce budworm [*Tortrix fumiferana*, Clem.] and the larch sawfly [*Lygaeonematus erichsoni*, Htg.], which in eastern Canada in the past 45 years have destroyed commercial timber estimated at 200 million cords. Tests in controlling *T. fumiferana* by dusting infested areas from aeroplanes were conducted in three Provinces during 1927–29, but owing to its extreme resistance to poison dusts further experiments are necessary. In 1929, in Quebec, similar tests were conducted against the hemlock looper [*Ellopia fiscellaria*, Gn.] on balsam fir [*Abies balsamea*] and spruce; dusting with 15 tons of calcium arsenate over an area of 2½ square miles, at the rate of 10 to 20 lb. to the acre (or about one ton of dust to the hour), gave 90 per cent. control. Similar operations against this pest on hemlock [*Tsuga*] in Ontario and on a smaller scale in British Columbia gave very satisfactory results. This method of control will be most useful against insects such as *E. fiscellaria*, which appear on small areas and spread rapidly over extensive stands of timber, feeding in an exposed condition on the foliage.

GAHAN (A. B.). **Synonymical and descriptive Notes on parasitic Hymenoptera.**—*Proc. U.S. Nat. Mus.*, lxxvii, art. 8, no. 2831, 12 pp. Washington, D.C., 1930.

Among the new species described are the Braconids, *Opius bellus* from *Anastrepha fraterculus*, Wied., in the Panama Canal Zone, and *O. lectoides* from *Rhagoletis pomonella*, Walsh (*symphoricarpi*, Curr.) on snowberry [*Symphoricarpus*] in Oregon; the Eulophids, *Horismenus depressus* from *Bruchus pruininus*, Horn, in California, and *Pleurotropis detrimentosus* from cocoons of *Perisierola* sp. attacking *Nephantis serinopa*, Meyr., in India; and the Chalcid, *Brachymeria nephantidis* from *N. serinopa* in India. Notes are given on the hosts and synonymy of other species, including *Aphidencyrtus aphidivorus*, Mayr (*schizoneurae*, Ashm., *aphidiphagus*, Ashm., *megourae*, Ashm., *websteri*, How.); *Telenomus connectans*, Ashm., and *T. sphingis*, Ashm. (*monilicornis*, Ashm.), both obtained without hosts in St. Vincent and from eggs of *Protoparce* (*Phlegethontius*) *sexta*, Joh., in San Domingo, and the latter from the same host in Porto Rico, Tennessee and Florida; and *Cephalonomia tarsalis*, Ashm. (*kiefferi*, Fouts), the commonest Bethylid attacking stored product pests in America, including *Silvanus* (*Oryzaephilus*) *surinamensis*, L., and *Calandra* (*Sitophilus*) *oryzae*, L.

Rhabdepyris zeae, Wtstn., originally described from England as associated with Coleoptera in maize from West Africa, has now been recorded from Indiana, probably parasitising *Tribolium confusum*, Duv.

UCHIDA (T.). **Beschreibungen der neuen echten Schlupfwespen aus Japan, Korea und Formosa.** [Descriptions of new Ichneumonids from Japan, Korea and Formosa.]—*Insecta matsum.*, iv, no. 3, pp. 121–132, 3 figs. Sapporo, March 1930.

Among the new species described are *Pimpla tabatai* from the Lasiocampid, *Dendrolimus albolineatus*, Mats., *Angitia pyraustae* from the Pyralid, *Pyrausta nubilalis*, Hb., and *Mesochorus narangae* from the Noctuid, *Naranga aenescens*, Moore, all from Japan.

KALSHOVEN (L. G. E.). **De biologie van de djatitermiet** (*Kalotermes tectonae* **Damm.) in verband met zijn bestrijding.** [The Biology of the Teak Termite in Connection with its Control.]—Med. 8vo, xi+154 pp., 20 pls., 9 figs., 54 refs. Wageningen, Thesis, Landbouwhoogeschool, 1930. (With a Summary in English.)

An account is given of observations, begun in 1925, on *Calotermes tectonae*, Damm., which is a serious pest of teak in Java [*R.A.E.*, A, iv, 155 ; x, 624]. The methods followed for collecting the colonies as complete as possible are described. Descriptions are given of all stages of *C. tectonae* and of the imago and soldier of a new species, *C. dalbergiae*, which has similar habits, but has only been found locally, whereas *C. tectonae* is widely distributed in the teak forests. In the living trunks the nests are always at a height of several yards, because the colonies are founded in the remains of dead branches under or inside the crown. In teak the injury results in conspicuous swellings. Lists are given of trees attacked by *C. tectonae*, and of those so far found to be immune. The development of the colonies is very slow in the first years, and there is no danger of the infestation spreading until the swelling is 3–6 years old. There is thus ample time to remove infested trees. When the wood of an infested tree is drying, the colony can still persist for some time, and the appearance of sexual forms is hastened. Trees with swellings must not therefore be left standing when ringed, and swellings removed when the timber is cut up must be burnt or otherwise dealt with. The swarming of the sexual forms lasts for weeks and occurs in the first half of the west monsoon [wet season]. The winged termites do not appear to have any inclination to leave the forest, and probably new colonies are formed only in the immediate vicinity of the old ones. If, however, they issue from wood outside a forest, they fly to it, so that infested wood intended for fuel should not be stacked near a forest.

LEEFMANS (S.). **Een ernstige engerlingenplaag op eene thee- en rubberonderneming veroorzaakt door** *Exopholis hypoleuca* **Wied.** [A serious Cockchafer Infestation in a Tea and Rubber Plantation due to *E. hypoleuca*.]—*De Bergcultures*, iii, p. 1999 (reprint 16 pp.). ? Batavia, 28th December 1929.

Tea and rubber in a plantation near Buitenzorg, Java, were severely infested by the larvae of *Exopholis hypoleuca*, Wied. This Melolonthid is common in Java and occurs on other islands of the Dutch East Indies, at altitudes between 300 and 3,000 ft. Records of various food-plants are given. At Buitenzorg the egg-stage lasted 12–14 days ; the larval, 264–318 ; the pupal, 17–24 ; and the resting stage of the adult

after emergence, 17–37. In this locality, at an altitude of about 800 ft., the chief flight occurs in October-November. At higher altitudes it is later, and above 3,000 ft. development probably requires more than a year. The adults feed on the leaves of cacao, banana, coconut, and other trees. In captivity from 14 to 58 eggs were laid by a female. On the infested plantation nearly 13,500,000 larvae were collected over an area of about 330 acres. In plots of young *Hevea* containing *Tephrosia candida, Clitoria laurifolia, Crotalaria anagyroides,* and *Calopogonium,* and covering about 130 acres, over one-quarter of the rubber had to be replanted, together with all green manure plants except *Tephrosia* and *Clitoria,* which were not attacked. *Hevea* planted in January was in quite good condition, but that planted in March had suffered severely ; possibly the former had become well established before the larvae were present. Tea, owing to its different root-system, was much less severely injured. *Hevea* had previously been only slightly attacked, but it is possible that *E. hypoleuca* may develop into a serious pest of this plant. In one instance, rubber nurseries in heavier, clay soil were not attacked.

Dodd (A. P.). **The Progress of Biological Control of Prickly-pear in Australia.**—Med. 8 vo, 44 pp., 12 pls. Brisbane, Commonwealth Prickly-pear Bd., October 1929.

This report continues the record of operations of the Commonwealth Prickly-pear Board [*R.A.E.*, A, xvii, 105] to the end of May 1929, and reviews the present situation with regard to the control of *Opuntia* spp. The method of shipping their insect enemies from America and the work of their acclimatisation and establishment in Australia, and research work with introduced insects and diseases of prickly pear are discussed. It is considered that the introduction of the Pyralid, *Cactoblastis cactorum,* Berg, has changed the future prospects with regard to possible eradication of the pear, which, it is hoped, will within a few years have completely disappeared over vast areas. *C. cactorum* has been established in Australia without great difficulty and has shown greater hardiness than allied species in withstanding wet weather. Large numbers of the moth borers, however, succumb to extreme heat combined with lack of humidity, the cocoons being destroyed, the adults dying without ovipositing, and the eggs themselves becoming desiccated. A combination of hot and dry conditions has prevented the moth from yielding a normal increase in one district. The Chalcid, *Stomatoceras melitarae,* Gir., the only important one of the four native parasites of *C. cactorum,* attacks the cocoons, though the proportion destroyed rarely reaches 5 per cent., except in Central Queensland, where the degree of parasitism has been as high as 12 per cent. in some instances. In certain districts the larvae are also preyed upon by birds.

C. cactorum differs from the other enemies of prickly pear in the great rapidity with which it destroys it. In some cases the area of destruction has increased tenfold or more in four months, and it is estimated that at least 30,000 acres of prickly pear have been destroyed by the moth, chiefly in the last 12 months. *C. cactorum* is a native of Uruguay and the north of Argentina, in which country it was found in 1914 [*R.A.E.*, A, iii, 126] and again in 1924. About 3,000 eggs were exported in 1925 to Australia, where the insect proved an immediate success. The larvae throve throughout the winter on *O. inermis* and *O. stricta,* and in September produced moths that laid 100,000 eggs.

The second generation yielded 2,540,000 eggs, an increase of over 900 per cent. in 12 months. Liberations comprising 9,000,000 eggs were made during the period February 1926 to March 1927 from the north-western fringe to the southern extremity of the infested country. At this juncture it was possible to abandon the rearing of larvae in cages, the necessary eggs being laid by moths emerging from cocoons collected in the field. The Board discontinued liberation work in March 1927, and the State organisations that took it over have released over 300,000,000 eggs between September 1927 and March 1929.

The eggs are laid in long chains of up to 150, averaging 75, and take 3–6 weeks to develop. One female may deposit 200 eggs, but the average is 100. The larvae live in colonies of 20–100 within the pear segments, emerging only rarely. When mature, they spin white cocoons under the bark or between the destroyed pear-joints. The cocoon stage lasts 3–6 weeks, and the moths live only a few days. There are generally two generations a year, oviposition taking place in September-October and January-February. The summer brood of larvae develops in 4–8 weeks, but the winter brood spends 6 months in the larval stage. In Central Queensland a third generation occurs, so that all stages of the moth can be found almost all the year round. The larvae eat out the interior of the pear joints, tunnelling from joint to joint or leaving a destroyed pad to seek fresh quarters. The whole of the inside of the younger segments is eaten, but older pads are not destroyed entirely, though wet rots, caused by fungi and bacteria, rapidly complete the work. The larvae may penetrate into the underground bulbs and even the roots of the plants, and with the aid of associated rots the clumps may be entirely killed. Although the moths have been known to travel at least 10 miles before depositing their eggs, most of them oviposit in the immediate vicinity of their place of emergence, so that as many as 1,000,000 eggs may be laid to the acre.

Though rather less successful in some of the more southern areas, *C. cactorum* appears to be particularly adapted to the greater part of the infested territory and to be specially inimical to *Opuntia inermis*. The succulent type of this species is more readily destroyed, but effective work has also been done on the more resistant type of the open forest lands. *O. stricta* of Central Queensland is rapidly eradicated in the scrub lands, but the rate of destruction in the open country is much slower than in the case of *O. inermis*. *O. aurantiaca* is also readily destroyed. *O. streptacantha*, although freely attacked, is not completely eradicated except in the case of the young plants. The young plants of *O. tomentosa* are destroyed, but the moths seldom oviposit on the larger ones.

Other enemies of *Opuntia*, of which a brief account is given, are *Chelinidea tabulata*, Burm., *Dactylopius* spp., and *Tetranychus opuntiae*, Banks. In an appendix, a list is given of the insect enemies of the Cactaceae, all of which are exclusive to that family.

Roughley (T. C.) & Welch (M. B.). **Wood Borers damaging Timber in Australia.**—*Bull. Technol. Mus.*, no. 8, 2nd edn., 27 pp., 18 figs. Sydney, 1929. Price 1*s*.

This edition is almost identical with the previous one [*R.A.E.*, A, xiii, 228]. It has been generally assumed that *Lyctus brunneus*, Steph. (powder post beetle) lays its eggs only in seasoned timber that is probably dry right through; beetles, however, have been observed to

emerge from timber that has been felled not more than five months. The borers have also been observed working in cedar of which the average moisture content was 47 per cent. Probably the most effective treatment against all borers in seasoned timber is heating at a temperature of 114–117° F. The degree of heat penetration in a moderately dense wood is such that within five minutes after exposure, all borer life in 1 inch boards is destroyed.

NEWMAN (L. J.), O'CONNOR (B. A.) & ANDREWARTHA (H. G.). **Wax Scale** (*Ceroplastes ceriferus*, **Anderson**).—*J. Dept. Agric. W. Aust.*, (2) vi, no. 4, pp. 516–526, 8 figs. Perth, W.A., December 1929.

Ceroplastes ceriferus, And. (Indian wax scale) was introduced into eastern Australia in 1897, and from there spread into Western Australia on *Citrus* in 1911. It has since been recorded in the latter State on various native plants, and apricot, pear and persimmon, in proximity to *Citrus*, have also been found slightly affected. Observations over a period of 2 years indicate that each female is capable of laying 900–1,000 eggs, and although there is only one generation a year, there are individual variations in egg development and hatching. Oviposition begins about the first week in October and continues at intervals until the first week in December. It was found that before all the scales had oviposited, 30 per cent. of the first eggs laid had already hatched, but the larvae were still living under the parent scale. Eggs not laid till December would not hatch till the first week in February, but the main issue takes place from 20th December to 7th January, and the first treatment is recommended to be applied about 7th–10th January. A second treatment for belated larvae may be applied at the end of February. The newly emerged larvae crawl on the leaves, where they settle temporarily and construct their waxy coverings. Three weeks later those that survive migrate, though a large proportion fall to the ground or die in the process, and only about 10 per cent. of those emerging reach maturity. By the end of January most of the scales have settled down into their permanent position on the young wood. The shape of the wax covering begins to change about mid-February, and further pointed wax secretions appear, eventually hiding the scale completely. After reaching the adult stage, the scales continue to feed, and the development of the eggs, which occupies a period of 3 months, begins, eggs being discernible in scales dissected in mid-July. The male has not yet been discovered. A brief description of each stage is given.

C. ceriferus may be controlled at its most vulnerable stage by the application of a contact oil spray, or of a solution consisting of $\frac{3}{4}$–1 lb. washing soda to 1 gal. water. Soda ash may also be used at half this strength. In using the soda, which eats away the wax, leaving the Coccid exposed and dead, care must be taken to prevent the spray from reaching the ground, as it damages the roots and has an adverse effect on the chemical and physical condition of the soil. The whole of the tree and both surfaces of the leaves should be thoroughly coated. Experiments in spraying the adults in October before the eggs were laid gave unsatisfactory results, as the extent of the waxy covering then present proved resistant to all the materials used. A small percentage of the scales was found to be parasitised by the larvae of a Chalcid.

Newman (L. J.). **Report of Entomologist.**—*Ann. Rep. Dept. Agric. W. Aust. 1928–29*, pp. 32–33. Perth, W.A., 1929.

Much of the information contained in this report has already been noticed from individual papers by the author. Calcium cyanide dust was successfully used at the rate of 25 lb. to the acre against *Nysius vinitor*, Bergr., and *Nezara viridula*, L., especially against the nymphs, and *Smynthurus viridis*, L. For treatment of stacking sites and flooring dunnage against the grain weevil [*Calandra granaria*, L.], it was only partly successful. Lead arsenate dust proved very effective against *S. viridis* and *Heliothis* (*Chloridea*) *obsoleta*, F. In pastures the former may be controlled by fallowing every third year before the over-summering eggs have been produced. Other pests occurring in Western Australia during 1928–29 include *Listroderes obliquus*, Gyll. (tomato weevil), which caused considerable damage in gardens, *Plutella maculipennis*, Curt. (*cruciferarum*, Zell.) (cabbage moth), and *Bryobia praetiosa*, Koch (*pratensis*, Garm.). *Cydia pomonella*, L., was entirely absent from areas previously infested. In a district where fruit trees were formerly severely attacked by fruit-fly [*Ceratitis capitata*, Wied.], the crop was marketed without a single case of condemned fruit, owing to the co-operative use of bait-sprays. Only one outbreak of *Chortoicetes terminifera*, Wlk., occurred in the far eastern area, and this was successfully dealt with by poison baits.

Thorp (J. H.). **Control of Codlin-moth in Orchards.**—*N.Z. J. Agric.*, xxxix, no. 6, pp. 396–397. Wellington, N.Z., 20th December 1929.

The author considers that, at any rate so far as conditions in New Zealand are concerned, the difficulty in controlling the codling moth [*Cydia pomonella*, L.] on apples is only due to inefficient spraying and failure to destroy infested fruit, etc. He therefore gives a brief review of the measures required, laying particular stress on proper sanitation in the orchards and in and around the packing sheds. The regular application of lead arsenate (1½–2 lb. to 100 gals. water) should begin with the calyx spray and be continued at intervals of 14 days up to the end of December and thereafter every 21 days up to the end of February. The addition of ½ lb. spreader to the later sprays may be desirable to ensure a better covering.

Muggeridge (J.). **Entomological Investigations.**—6 pp. multigraph. [New Zealand] 3rd October 1929.

Plutella maculipennis, Curt. (diamond backed moth) causes serious damage to rape and turnips in New Zealand. Parasitism by an Ichneumonid, probably *Angitia lateralis*, Grav., amounted to about 7 per cent. It is intended to introduce *A. fenestralis*, Holmgr., and *A. plutellae*, Vier. ; before liberating these parasites experiments are to be made to test whether competition between them would tend to reduce their efficiency.

In 1929 a survey of the possible insect vectors of potato virus diseases was made. The insects found included *Myzus persicae*, Sulz., *M. solani*, Kalt. (*pseudosolani*, Theo.), *Macrosiphum gei*, Koch,

Erythroneura sp., and various thrips, Collembola, etc. Surveys of a field in an important potato-growing locality revealed that *Myzus solani*, *M. persicae* and *Macrosiphum gei* were present on the plants in small numbers during the growing of the first crop, from July to October; the first two increased in numbers towards the end of this period, *Myzus solani* being by far the most abundant throughout the season, while *Macrosiphum gei* was very scarce indeed. *Myzus solani* was also found on dock [*Rumex*] growing among the potatoes; it is able to reproduce during the winter on this plant.

In future work on the biological control of the pear midge [*Dasyneura pyri*, Bch.] [*cf. R.A.E.*, A, xvi, 78], it is hoped to ascertain the number of generations of the midge and the theoretical efficiency of the parasite, *Misocyclops marchali*, Kieff., in controlling it.

MIMEUR (J.). **Un nouveau parasite du cotonnier au Maroc** (*Platyedra vilella*, **Zeller**).—*Rev. Path. veg.*, xvii, fasc. 1, pp. 4–6, 4 refs. Paris, January 1930.

Platyedra vilella, Zell., has been recorded from various parts of Europe, north Africa and Asia Minor, but has never been considered a pest, as the larva was only known to attack the wild malvaceous plants, *Lavatera arborea* and *Malva sylvestris*. During 1929 in Morocco, the larvae were found devouring the ovaries and flower buds and capsules of cotton plants. Their entrance holes resembled those of *Earias insulana*, Boisd., the larvae generally occurring at the base of the calyx, near the flower peduncles or on the tips of the bolls. Although not numerous on cultivated cotton, they were abundant on *L. trimestris* adjacent to cotton fields, attacking all aerial parts of the plants, and in the laboratory completed their development on the dry seeds. In rearing experiments, pupation occurred in light cocoons hidden in folds of dried bolls, and the pupal stage lasted 13–16 days. The adult is described, and the larvae are compared with those of *P. gossypiella*, Saund., for which they may easily be mistaken.

GRANDI (G.). **Il** *Sinoxylon sexdentatum* **Oliv. e i cavi telefonici.** [*S. sexdentatum* and Telephone Cables.]—*Boll. Soc. ent. ital.*, lxii, no. 1, pp. 17–19. Genoa, 25th January 1930.

The Bostrychid, *Sinoxylon sexdentatum*, Ol., occurs throughout the Mediterranean basin. It is polyphagous, but prefers figs and vines, of which it infests withered and dead branches, or those that have been recently cut. The eggs are laid beneath the bark in May and June. The larvae live in the wood and pupate near the bark. The adults emerge at the end of summer or in autumn and hibernate in specially excavated shelters or sometimes in the pupal cell. In several instances in Italy the beetles have recently attacked lead-covered aerial telephone cables. The perforations are usually made near the supporting hooks, as these afford the foot-hold necessary in boring into a smooth surface. The holes are made in summer, but the harm done is noticed only when rain penetrates and rots the envelopes of the various wires, thus causing a short circuit.

Pérez (M. Q.). **Estudio biológico del icneumónido** *Aphidius avenae* **Hal., parásito de los pulgones verdes.** [A biological Study of *Aphidius avenae*, a Parasite of Green Aphids.]—*Eos*, v, no. 4, pp. 427–439, 5 figs. Madrid, 26th December 1929.

In eastern Spain, various green Aphids on lucerne, peach, etc., are heavily parasitised by *Aphidius avenae*, Hal. A description of the larva and adults of both sexes is given. The eggs hatch in 2–3 hours, and development is completed in 6–7 days. The rate of parasitism averages 70–75 per cent. and may be over 90. The female passes its entire life of over 6 days in oviposition, feeding at intervals on the honey-dew produced by the Aphids. The fact that the eggs mature in the ovaries so rapidly as to need constant deposition prevents the female from flying and limits the spread of the parasite. It does not usually leave a leaf until all the Aphids on it have been parasitised. It is therefore advisable to distribute the parasite, even in small numbers, for the 12–15 generations that occur in three months will soon check any infestation.

Biron (M.). **Un poison mortel pour les vers de la vigne.**—*Prog. agric. vitic.*, xciii, no. 6, pp. 146–148. Montpellier, 9th February 1930.

Experiments made with different arsenical salts against the larvae of the vine moth [*Polychrosis botrana*, Schiff.] in 1929 proved that copper arsenite is the best poison to mix with sprays such as Bordeaux mixture. The formula used was 20 lb. copper sulphate and 30 lb. lime [to 100 gals. water], to which was added 10 lb. lead arsenate, 8lb. calcium arsenate, or 1½ lb. copper arsenite. The action of copper arsenite on the larvae is somewhat complicated and variable, and is not thoroughly understood in spite of some years' observations, but it is always found to be the strongest and surest killing agent, and is, moreover, easier to use than lead arsenate, which is apt to clog the apparatus.

Paillot (A.). **Traitement d'hiver des arbres fruitiers par les émulsions d'huile minérale en bouillie cuprique.**—*C.R. Acad. Agric. Fr.*, xvi, no. 5, pp. 181–183, 1 ref. Paris, 1930.

In view of the attention recently drawn to the difficulties experienced in preparing Bordeaux-oil emulsions, including an anthracene oil emulsion already noticed [*R.A.E.*, A, xii, 106], for winter treatment of fruit trees, the possible causes of failure are discussed, the chief of which appears to be insufficient sifting of the lime. The addition of casein to the mixture presents no difficulties, since the powder can simply be added to the lime, but about 1½ pt. of skim milk can be substituted for it, this being added after the Bordeaux mixture is made. The preparation of the emulsion may be further simplified by the addition of certain sulpho-naphthaline products to the anthracene oil at the rate of 2 : 100, which make it directly emulsifiable in the Bordeaux mixture. As the emulsifier can be added long before use, the oil can be delivered in an emulsifiable condition without any great increase in the cost. At the present price of the chief ingredients, the cost of the emulsion will not exceed 2½*d.* a gallon. A single winter application will be sufficient to clean the trees and control both Coccids and fungous diseases, whereas a treatment with miscible oil usually necessitates a further application of Bordeaux mixture.

WILLAUME (F.). **Sélection des principaux types de formules adaptés au traitements d'hiver des arbres fruitiers.**—*C.R. Acad. Agric. Fr.*, xvi, no. 5, pp. 184–190, 7 refs. Paris, 1930.

The author briefly reviews the types of sprays that may be used for the winter treatment of fruit trees, of which he considers tar distillates (carbolineum) to be the most satisfactory. The best type is composed of anthracene oil rendered miscible in water by the addition of soap. The term carbolineum should only be applied to commercial preparations containing a minimum of 50 per cent. anthracene oil and a maximum of 2 per cent. phenol and 4 per cent. organic bases, without any additional ingredient likely to injure vegetation, the emulsifier being preferably resin soap. Carbolineum may be applied during the dormant period of vegetation to apple and pear trees and vines at a concentration of 10 per cent., and to bush fruits and trees bearing stone fruit at 5–6 per cent. It is very effective against Coccids, the dormant eggs of Aphids and the eggs of *Psylla mali*, Schmidb., and slightly less so, though still satisfactory, against the eggs of *Cheimatobia brumata*, L., and of Tortricids, 50–80 per cent. of which are destroyed. Carbolineum has also been reported to be effective against the eggs of *Argyresthia nitidella*, F., but does not control those of *Hyponomeuta*, *Bryobia* and *Tetranychus*. The leaves of treated trees become larger, more numerous and greener than those of untreated trees.

ELLINGER (T.) & CHORINE (V.). **Sur les microbes d'***Ephestia kühniella* **Zell.**—*C.R. Soc. Biol.*, ciii, no. 6, pp. 401–402, 5 refs. Paris, 1930.

As the result of a comparative study, the authors state that the two strains of bacteria that were isolated from *Ephestia kühniella*, Zell., by Metalnikov and Chorine and utilised by them against *Pyrausta nubilalis*, Hb., and were referred to as *Bacterium thuringiensis*, nos. 1 and 2 [*R.A.E.*, A, xviii, 143, 144] and subsequently as *B. ephestiae*, nos. 1 and 2 [xviii, 207, 256], are identical with *B.* (*Bacillus*) *thuringiensis* isolated by Berliner and subsequently studied by Husz [viii, 252 ; xvii, 219 ; xviii, 148].

DINGLER (M.). **Ein Kleinschmetterling** (*Argyroploce lacunana* **Dup.**) **als Schädling an Buchensaat.** [A Microlepidopteron, *A. lacunana*, as a Pest of sown Beech Seed.]—*Forstwiss. Zbl.*, lxxiii, pp. 673–676, 2 figs. Berlin, 1929.

In 1929 small beech seedlings from seed sown under pines were attacked by the larvae of *Argyroploce lacunana*, Schiff., which fed principally on the cotyledons. Beech has not previously been recorded as a food-plant of this moth. The Ichneumonid parasite, *Phytodietus segmentator*, Grav., was taken on one of the infested plants.

REH (L.). **Ueber die Ursachem stärkeren und schwächeren Auftretens von Insekten.** [On the Causes of the greater or less Abundance of Insects.]—*Anz. Schädlingsk.*, vi, no. 1, pp. 1–3. Berlin, 15th January 1930.

The author agrees with Bodenheimer [*R.A.E.*, A, xvii, 489] that temperature and humidity are the chief factors governing the abundance of insects, and discusses various points in Friederich's review of Bodenheimer's paper [xviii, 26].

KALANDADZE (L.). **Zur Biologie der Blutlaus** *Schizoneura lanigera* **(Hausm.). (Vorläufige Mitteilung.)** [On the Biology of the Woolly Aphis, *Eriosoma lanigerum*. Preliminary Communication.] —*Anz. Schädlingsk.*, vi, no. 1, pp. 3–6, 1 fig., 1 ref. Berlin, 15th January 1930.

Observations on *Eriosoma* (*Schizoneura*) *lanigerum*, Hausm. (woolly apple aphis) were made in 1927 in the Rhine Palatinate and in 1928 in Georgia. It was found that the capacity for movement is very marked in first-stage larvae. They can travel on paper at the rate of 3–4½ yards an hour, but can only spread for small distances in nature because their progress on the ground is slow and difficult. They can resist starvation for 5–6 days on an average. Older larvae become more and more incapable of movement and less resistant to hunger. The Aphids can survive for a fortnight on cut one-year-old branches lying on damp earth in the shade. They can live for a considerable time under water, sometimes 9–12 days, according to the age of the branches and the thickness of the wax coating. This would suggest that the method of submerging the roots of infested apple trees is of little value. Alatae occurred in the Palatinate from 24th June until early November, but in Georgia they did not appear until 10th September onwards [*cf.* *R.A.E.*, A, xiii, 314 ; xiv, 221]. In the Palatinate the alatae almost always produced sexuales, and only rarely did young with a long proboscis appear [*cf.* xiv, 221]. In Georgia the alatae produced sexuales exclusively. One individual produced 2–5 larvae on an average. In experiments in the Palatinate, alatae and sexuales were placed on the branches of *Ulmus americana* in gauze bags. Three weeks later no eggs or living sexuales were to be found, and in the following spring no galls occurred on the leaves. No observations could be made in Georgia as *U. americana* was absent. This seems to confirm the view that the European strain of the Aphid is a special biological race confined to apple, and that the alatae producing sexuales have no significance.

Natural enemies observed in the Palatinate included the Chrysopids, *Chrysopa septempunctata*, Wesm., *C. prasina* var. *abdominalis*, Burm., and *C. formosa*, Br., but they are unimportant as regards control. The introduced parasite, *Aphelinus mali*, Hald., appears more promising.

MORSTATT (H.). **Die Mittelmeerfruchtfliege,** *Ceratitis capitata* **Wied.** [The Mediterranean Fruit-Fly.]—*Anz. Schädlingsk.*, vi, no. 1, pp. 6–8. Berlin, 15th January 1930.

This is a brief survey of the history of the occurrence of *Ceratitis capitata*, Wied., throughout the world.

ECKSTEIN (—). **Etwas vom Kohlweissling** (*Pieris brassicae* **L.**). [Some Notes on the Cabbage White Butterfly.]—*Anz. Schädlingsk.*, vi, no. 1, pp. 9–10. Berlin, 15th January 1930.

A chronological account is given of laboratory observations on *Pieris brassicae*, L., between 25th November 1928 and 12th June 1929. Pupae kept in a room without artificial heat, but in which the temperature did not fall below freezing point, yielded adults before those kept in a warm room.

RAMBOUSEK (F.). **Die Rübenschädlinge im Jahre 1927 und 1928.** [Beet Pests in 1927 and 1928.]—*Z. Zuckerind. čsl. Repub.*, liv (xi), no. 11, pp. 105–114, 4 figs. Prague, 1929.

Most of the beet pests recorded in Czechoslovakia in 1927 and 1928 were the same as those observed in 1926 [*R.A.E.*, A, xv, 316]. Wireworms occurred in very great abundance, and naphthalene proved ineffective as a repellent against them if food was scarce. It is pointed out, however, that the Cryptophagid, *Atomaria linearis*, Steph., is often responsible for the injury attributed to them. Flea-beetles, *Haltica* spp., caused damage in some localities ; the injury done by *Cassida nebulosa*, L., and *C. nobilis*, L., is often attributed to them. *Phytometra* (*Plusia*) *gamma*, L., was a serious pest in 1928. Of its parasites, the commonest were the Tachinids, *Tachina larvarum*, L., *Pales pavida*, Mg., and *Bucentes cristata*, F., and the Ichneumonids, *Exetastes gracilicornis*, Gr., and *Pimpla examinator*, F. *Opius nitidulator*, Nees, was obtained from two pupae. The beet-fly, *Pegomyia hyoscyami* var. *betae*, Curt., which is the usual host of this Braconid, was not abundant. It was found that *O. nitidulator* can be bred on the larvae of *Lucilia caesar*, L., the common house-fly [*Musca domestica*, L.] and the bluebottle fly [*Calliphora vomitoria*, L.]. *Aphis fabae*, Scop., was numerous in 1927, but owing to parasites and rain it was scarce the next summer.

RAMBOUSEK (F.). **Ueber die Felddrahtwürmer. II. Biologischer Teil.** [On the Field Wireworms. II. Biological Part.]—*Z. Zuckerind. čsl. Repub.*, liv (xi), no. 20, pp. 197–201, 1 fig. Prague, 1929.

In Czechoslovakia the field wireworms [*cf.* *R.A.E.*, A, xvii, 208, 664] have different oviposition periods. *Lacon* (*Brachylacon*) *murinus*, L., *Corymbites* (*Selatosomus*) *aeneus*, L., *C.* (*S.*) *latus*, F., *Agriotes sputator*, L., and *A. obscurus*, L., oviposit in spring, *Melanotus brunnipes*, Germ., and perhaps also *Athous bicolor*, Goeze (*longicollis*, Ol.) and *A. obscurus*, Payk. (*haemorrhoidalis*, F.), in late spring or early summer, and *Agriotes ustulatus*, Schall. (the most common species), *Athous niger*, L., and *A. obscurus* in summer. Adults of the last two, however, often appear in spring. *Agriotes lineatus*, L., which is usually found in damp meadows, occasionally occurs in fields, but only on cereals. Adults are present from late summer to May. *Agriotes obscurus* and *A. sputator* also hibernate in the adult stage, as probably do *L. murinus*, *C. aeneus*, *C. latus*, *M. brunnipes* and *Athous* spp. The eggs of all the species are coated with an adhesive, so that they become covered with soil particles. For observation purposes, they should be taken from the ovaries and the larvae bred with sufficient moisture and air.

The larvae of *Agriotes ustulatus* hatched in 6 days and survived without food for three weeks. This capacity to resist starvation explains why severe injury occurs in fields where food is available for only part of the year. The eggs are usually laid in fields with perennial plants such as clover and lucerne. The larvae come to the surface of the soil at night after rain or heavy dew. In spring they can be found 1–4 inches beneath the surface, hibernation occurring at greater depths. Newly sown beet-seed is very attractive, and as long as it is available, the beet plants are not attacked. The pupal stage was found to last 1–3 weeks, pupation occurring in June, or sometimes in May. The adults live in summer on umbelliferous and other plants, feeding on the pollen. *Agriotes obscurus* pupates early in April.

The measures advised against these wireworms include collection of the adults and the use of baits for the larvae. Poultry, particularly turkeys, have proved of considerable value in clearing the larvae from the fields. Attempts to infect the latter with *Beauveria bassiana* were unsuccessful.

Vos (H. C. C. A. A.). **De invloed van** *Pseudococcus citri* **(Risso) Fern. op de plant.** [The Influence of *P. citri* on the Plant.]—Med. 8vo, [10] 81 pp., 38 figs., 3 pls., 34 refs. Rijks-Univ. Utrecht, Thesis, 1930.

Pseudococcus citri, Risso, on *Coleus* was used in experiments on the effect of infestation by Coccids on plants. Its biology and developmental stages are described, some original notes being included. Males amounted to 20 per cent. of the adults. Twenty-four hours after 800 larvae had been placed on the upper leaf-surface only 47 were still there ; all the others had moved to the lower, shaded surface. In boxes, however, the larvae moved towards the light, but this difference in behaviour has not been explained. The saliva, the puncturing, and the effect of infestation are discussed. The injury done appears to be solely due to the removal of food-material from the plant.

Reports received from Experiment Stations, 1928-1929.—Med. 8vo, xi+268 pp., ill. London, Empire Cotton Growing Corp., 1930. Price, 2*s*. 6*d*.

Cotton pests at the Biloela Station, Queensland, are discussed by W. G. Wells (pp. 22–24). Cotton was planted late, and, probably in consequence, suffered more from the attacks of *Heliothis obsoleta* F. (corn ear-worm) than ever before. Evidence again points to the theory that damage from this moth is correlated with late planting on rich alluvial loamy soils ; late-planted crops on clay soils seem to be remarkably free from attack, probably because growth is slower and so the plant is less attractive. *Thrips tabaci*, Lind., caused serious loss of terminals in many plots planted in November, doubtless owing to scarcity of rain [*cf.* *R.A.E.*, A, xvii, 293]. Some larvae of *Platyedra gossypiella*, Saund. (pink bollworm) were taken on ripe or green bolls, together with *Earias huegeli*, Rogenh. (rough bollworm) and *Dichocrocis* (*Conogethes*) *punctiferalis*, Guen. (peach or maize grub) ; it is not of any serious importance at present, but very careful clearing up of the crop is necessary. *Aulacosternum nigrorubrum*, Dall. (false stainer) is increasing in numbers and is probably the cause of punctures that have previously been attributed to *Dysdercus cingulatus*, F. (*sidae*, Montr.) and to *Tectocoris lineola*, F., and perhaps of square shedding and loss of terminals.

From Natal (Candover), F. S. Parsons and P. A. Bowmaker report (pp. 71–72) a light infestation of *Diparopsis castanea*, Hamps. (Sudan bollworm) in the spring, which gradually increased on ratoon cotton in January ; in March and April it was abundant and heavily damaged late crops. *H.* (*Chloridea*) *obsoleta* was abundant in January and February, almost ruining the ratoon crop and greatly reducing the yield from plant cotton. *Dysdercus* spp. (cotton stainers) appeared in April. Experiments to determine the best date for planting began on 29th October, and cotton planted on that date was less stained than

that planted later. *Syagrus rugifrons*, Baly, is now considered a major pest of cotton in Natal. Besides the measures already noticed [xvii, 293], growers are urged to plant a few rows of cotton with the appearance of the earliest spring rains, even in roughly prepared ground, in order to attract the beetles before the main crop is planted, and to dust heavily these small areas, as the beetles have been observed to concentrate on self-sown cotton plants in spring or late winter. *Busseola fusca*, Fuller (maize stalk borer) was so destructive that no grain could be produced from *Sorghum* grown near native-grown maize and *Sorghum*, though in other localities good crops were harvested.

Experiments with light traps for *Diparopsis castanea* were continued by C. B. R. King in Portuguese East Africa near Lorenzo Marques (pp. 85–90). Acetylene lights were found to attract females, nearly all of which when captured were gravid, but electric light attracted more strongly than acetylene ; moreover, the use of acetylene involves a good deal of labour and supervision. Generally speaking, about 20 candle power per acre seemed necessary with acetylene, and electric light was about six times as effective. The problem of range of effectiveness of the lights, however, is probably complicated by the absorption of the light rays of shorter wave lengths. Experiments in America and France with other insects [*R.A.E.*, A, xvii, 42, 332, 571] are quoted in support of this theory. The American bollworm moth [*H. obsoleta*] and the spiny bollworm moth [*Earias*] were both more attracted to electric light than to acetylene, but the numbers of the former were small, and the latter (of which 95 per cent. of the females taken were gravid) is not regarded as a very serious pest. On certain nights cotton stainers [*Dysdercus*] were strongly attracted, the average catch each night being 38 males and 28 females ; it seems likely that they are only susceptible to light after reaching maturity but before feeding. Insects are always more active during good conditions of humidity, and under such circumstances a wide range of temperature is tolerated. On most nights, humidity did not reach 80 per cent. until 9 or 10 o'clock at night, and moths are not usually caught before this time. The chief factors encouraging activity are humidity, warmth and stillness ; dryness and wind suppress it.

From Swaziland, D. Macdonald reports (pp. 102–103) that damage from bollworms was comparatively slight, *H. obsoleta* being the most injurious.

In Southern Rhodesia (Gatooma), J. E. Peat reports (pp. 112–119) that Jassids [*Empoasca facialis*, Jac.] were less injurious than in the past two years, probably owing to the planting of resistant varieties, but that after two years of comparative freedom from the attacks of bollworms, a severe outbreak of the American bollworm [*H. obsoleta*] occurred, probably owing to the lateness of the crop. It is considered a mistake to have planted the trap-crop of late maize through the cotton, thus encouraging the insects into the cotton plots ; maize is apparently preferred, and the attack only spread to cotton late, as the cobs of the main maize crop hardened. Larvae of *H. obsoleta* collected for breeding showed a high percentage (up to 85) of parasitism by two Tachinids, believed to be *Sturmia angustifrons*, Villen. and *S. munroi*, Curran. Cotton was dusted with calcium arsenate and lead arsenate in the middle of April, but this was apparently too late, as the smaller larvae only were killed. Dusting, to be effective, should probably be done when the attack is severe on maize but little developed on cotton. It would seem that in normal seasons the larvae are early controlled by

Tachinid parasites. Stainers [*Dysdercus*] did not cause any serious damage, probably owing to the measures taken during the past two years. Various attractants were tried on the cotton-seed traps, such such as cotton-seed oil, molasses, vanilla in alcohol, aniseed, and orange juice, but plain cotton-seed, whether crushed or uncrushed, appeared to be the most effective. Aphids [*Aphis gossypii*, Glov.] were troublesome, but no method of dealing with them on a commercial scale has been devised, and their attacks are usually checked by a Dipterous parasite.

From Northern Rhodesia (Mazabuka), A. G. Bebbington and W. Allan report (pp. 138–143) infestations of the Jassid, *Empoasca facialis*, apparently coming from the adjacent veldt. A common local species of *Thespesia* was suspected as the alternative food-plant, and cross-feeding experiments showed that development was similar on both plants. There are probably other wild food-plants also. *Diparopsis castanea* is present in the east of Northern Rhodesia but not apparently in the west. *H. obsoleta*, and *Earias insulana*, Boisd., are both recorded, but not as very serious pests ; they are apparently checked to some extent by parasites. The stainers present were *Dysdercus fasciatus*, Sign., *D. superstitiosus*, F., and *D. intermedius*, Dist., of which the first-named was by far the most numerous. Traps of crushed seed were used, some being placed on the ground in the normal way and some on iron sheets 40 yards apart. Against 3,982 females and 5,190 males caught from 19 rows of cotton during March to September by the former method, 6,287 females and 7,891 males were taken on the iron sheets. The traps were kept moist and renewed weekly. The Reduviid, *Phonoctonus principalis*, Gerst., was of common occurrence and was observed to attack a nymph of *Dysdercus*. *Aphis gossypii*, Glov., threatens to become a major pest, although checked to some extent by larvae of *Syrphus* sp., the Coccinellid, *Cydonia* (*Chilomenes*) *lunata*, F., and larvae of *Chrysopa* sp. Minor pests were the Pentatomids, *Callidea dregei*, Germ., which occurred on cotton and *Hibiscus cannabinus*, and may be associated with the spread of internal boll rot, and *Agonoscelis puberula*, Stål, which clustered at the base of young shoots, causing them to wilt.

From Fiji, R. R. Anson (pp. 266–267) records the scarcity of *Dysdercus insularis*, Stål, and *Platyedra gossypiella*, which is heavily parasitised by the Braconid, *Apanteles platyedrae*, Wlkn., and by a Chalcid. A Jassid, *Empoasca* sp., was the most troublesome pest, causing shedding of squares and flowers, but it disappeared during dry weather in July. Minor injury was done by *Tectocoris lineola* and *Earias fabia*, Cram.

KELSALL (A.). **Some new Insecticide-Fungicide Combinations.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 1–3. Tring, England, 1929.

A brief summary is given of results obtained in apple orchards in the Maritime Provinces of Canada from the experimental use of precipitated lime-sulphur mixtures, using zinc, iron and aluminium sulphates as the precipitating agents. The sprays were used alone and also in conjunction with lead arsenate, calcium arsenate and nicotine sulphate. Under conditions in Nova Scotia the zinc and iron sulphate mixtures proved unsatisfactory, though the iron sulphate mixture would probably be satisfactory in districts where high fungicidal properties are not so

important, but the aluminium sulphate and lime-sulphur mixture combined with each of the three insecticides gave results in insect control similar to those obtained with the corresponding lime-sulphur sprays. When used alone or with nicotine it was somewhat inferior to lime-sulphur as a fungicide, but was fully equal to it when combined with arsenicals. Used with nicotine the mixture caused no injury to apple foliage, but with lead arsenate there was some scorching in some of the experiments, and with calcium arsenate, although the mixture is considered safe, there were traces of " yellow leaf " following the last spray of the season in a few of the experiments on some varieties of apple. Injury of this type was small, however, when compared with the injury caused by the lime-sulphur on the lime-sulphur plots. This spray is very adhesive, being only slowly removed by rains. It is useless as a dormant spray against scale-insects, but is as effective as lime-sulphur for the summer control of the European red mite [*Paratetranychus pilosus*, C. & F.].

TILLYARD (R. J.). **The Biological Control of Noxious Weeds.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 4–9. Tring, England, 1929.

In discussing the question of biological control of noxious weeds, the author describes the precautions taken in New Zealand to prevent the liberation of insects that may become adapted to food-plants of economic importance, and gives a brief outline of the work carried out against prickly-pear [*Opuntia*] in Australia and against blackberry, gorse [*Ulex europaeus*] and ragwort [*Senecio jacobaea*] in New Zealand. With the establishment of a Central Entomological Research Station at Canberra and substations in various States it is intended that research concerning the biological control of various other weeds shall be greatly extended in Australia.

IMMS (A. D.). **Remarks on the Problem of the Biological Control of Noxious Weeds.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 10–17, 12 refs. Tring, England, 1929.

The principles on which the biological control of noxious weeds are based, are discussed. Numerous instances are recorded in which insects long known to feed upon a single species, genus or group of plant genera have been unexpectedly found to feed on other plants. Moreover, various experiments quoted from the literature indicate that it is possible for an insect to become rapidly adapted to an unusual food-plant to the extent of partly or completely rejecting its original host. These observations emphasise the possible risks attending the use of insects in weed control. A brief account is given of the work that is being done on the biological control of blackberry, ragwort and gorse in New Zealand, and the method of transporting the insects concerned from England to New Zealand in cold storage is described.

HOLDAWAY (F. G.). **The Pink Bollworm Situation in Australia.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 73–80, 2 figs., 42 refs. Tring, England, 1929.

The question of the identity and distribution of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., and *P.* (*P.*) *scutigera*, Hold., in Australia is

reviewed [*R.A.E.*, A, xiv, 459; xvii, 655], and the possibility of the former species being indigenous to India, Africa and Australia is discussed in connection with Wegener's hypothesis on the origin of continents.

REGNIER (R.). **De l'emploi du cyanure de calcium comme insecticide en France.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 87–89, 1 ref. Tring, England, 1929.

In France, the use of calcium cyanide as an insecticide has been almost exclusively confined to the treatment of insects in dwellings and greenhouses. Experiments were therefore undertaken to determine whether it could be used against insects attacking field crops, by applying it as a dust or by injecting it into the soil. The results of these investigations are discussed. It was found that as a dust it is ineffective against Rhynchota, including Aphids and Coccids, which can only be destroyed when the insecticide is used in a confined space such as a greenhouse or tent. In the case of subterranean larvae its efficacy depends on a number of factors, such as the individual resistance of the insect, its ability to escape from the gas, the nature of the soil and the degree of humidity. In sandy soils the mortality never exceeded 20 per cent., whereas in the clayey varieties, which retain the gas, as much as 80 per cent. was obtained. Moreover, the evaporation of the product is nearly twice as rapid under humid conditions as under dry ones, and applications should therefore be made in fine weather.

Meligethes aeneus, F., a small beetle that is very injurious to rape in one locality, was killed by dusting in less than 30 seconds, and 100 per cent. mortality was obtained.

BALLOU (H. A.). **The Status of the Cotton Leaf Worm** (*Alabama argillacea* **Hbn.**) **in the West Indies.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 94–96. Tring, England, 1929.

The cotton growing industry of the West Indies dates from about 1902, and *Alabama argillacea*, Hb. (cotton worm) appeared in large numbers in 1903, causing a considerable amount of damage in several of the Islands. Since that time it has occurred in all the cotton-growing regions in almost every season, with the exception of St. Vincent, and usually in sufficient numbers to be counted as a pest in one or other of the Islands. In St. Vincent slight attacks over limited areas were observed, generally in the south-eastern part of the Island, but these were controlled by natural enemies without the use of insecticides; the first general attack over the whole cotton-growing area occurred in 1926, when the losses were severe. The larvae appear in the cotton fields from June to January. The eggs are parasitised by *Trichogramma* and *Telenomus*, and a Chalcid and a Sarcophagid have been obtained from the pupae. Wasps of the genus *Polistes* are very efficient predators, but unfortunately they appear to be dying out in some of the Islands as a result of the attacks of a small moth that invades the nests. Paris green, London purple and, more recently, calcium arsenate have been employed against this pest, the insecticide being used as a dust, usually mixed with air-slaked lime at the rate of 1 part to 6 by weight, and applied by means of cloth bags. No difficulty would be experienced in controlling *A. argillacea* if frequent heavy showers during the growing season did not necessitate the repetition of dusting each day for several days while a brood is feeding.

Dampf (A.). **The present Status of the Fruit Fly Problem in Mexico.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 97–99. Tring, England, 1929.

The author describes the manner in which the Governments of the United States and Mexico are collaborating in the investigation of the problem of the control of the Mexican fruit-fly (*Anastrepha ludens*, Lw.), which was recently introduced into the State of Texas, and makes brief reference to other species of this genus that occur in Mexico.

Kuwayama (S.). **Some Observations on the so-called European Corn Borer in Japan.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 100–109, 26 refs. Tring, England, 1929.

In Japan, *Pyrausta nubilalis*, Hb. (European corn borer) is one of the most serious pests of Italian millet (*Setaria italica*) and maize, and is also known to attack hemp (*Cannabis sativa*), Chinese indigo (*Polygonum tinctorium*), hop (*Humulus lupulus*), beans (*Phaseolus* spp.), sugar-beet and many other plants, a list of which is given. The primary food-plant differs in the various localities, demonstrating the ability of the pest to accommodate itself to local conditions. An increase or decrease in the area under a certain crop may lead to an outbreak of the moth or to a change in its primary food-plant. The number of generations in a year varies from one to three according to the locality, and appears to be dependent on climatic factors. Data on temperature and precipitation in various localities and in different parts of the world indicate the possibility of using such factors in forecasting the number of generations that will occur in a given district.

In Hokkaido, the farmers frequently use bamboo-grass (*Sasa paniculata*) as poles for beans, and should the crop be infested, the full-grown larvae often hibernate in the poles. When the bamboo-grass is fresh, the larvae only bore through the hole in the upper end, which should therefore be cut off at the node. After two or three years' use, however, the larvae can enter the poles through every internode. Experiments on treatment of infested poles carried out in 1922 and 1923 showed that immersion in boiling water for 15 minutes was effective. If fumigation is employed, carbon bisulphide should be used at the rate of at least 10 lb. to approximately 1,000 cu. ft. for more than 24 hours.

Flanders (S. E.). **The Mass Production of *Trichogramma minutum* Riley and Observations on the Natural and Artificial Parasitism of the Codling Moth Egg.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 110–130, 6 diagrs., 14 refs. Tring, England, 1929.

An account is given of the rearing of *Trichogramma minutum*, Riley, on a large scale on *Sitotroga cerealella*, Ol., in California. Details of the equipment required and the procedure followed are given. Brief accounts of this method and of the modification of it in use in Canada have already been noticed [*R.A.E.*, A, xvii, 383, 455]. The optimum conditions for the cold storage of *T. minutum* have not yet been worked out, but the author now uses daily temperatures ranging from 1·7 to 7·2° C. [35·06–44·96° F.] with humidity varying from 40 to 75 per cent. The parasites reached maturity in 32 days when the average mean daily temperature for the period of development was 13° C. [55·4° F.] and in 26 days when it was 14·5° C. [58·1° F.]. In

the field, segments of the cards holding eggs of *S. cerealella* from which the parasites had begun to emerge were suspended in trees infested by the codling moth [*Cydia pomonella*, L.] by pieces of fine wire several inches long, thus decreasing the risk of attack by predators such as ants and Coccinellids. Complete emergence in the field usually occupies 3–6 days. The tendency of the males to emerge first and remain on the cards ensures pairing ; unfertilised females produce only males. The rate of dispersion varied directly with the temperature and light intensity, and inversely with excessive movement in the air and surface moisture. Cards should be suspended in the lower part of the tree, as the parasite is usually negatively geotropic. Light intensity appears to be the dominating factor in the activity of *T. minutum*, which is inactive at night [*cf.* xviii, 122]. The percentage of parasitism can be ascertained about two weeks after the first liberation, when the parasitised eggs turn black. In 1927, the release of *T. minutum* increased the percentage of parasitism on walnuts from less than 1 to as much as 52·4. In 1928, parasites were liberated on ten infested apple and pear trees. A comparison of the artificial parasitism obtained on these trees with natural parasitism on other pear and apple trees three miles distant showed that the highest natural parasitism was 45·7 per cent. and the highest artificial parasitism 72·9, that on each tree in the test plot being higher than the maximum on the control trees.

The basis for commercial control by means of this parasite is mass production at a low cost. It is probable that in the near future standardised methods in rearing will reduce the cost of production to less than £2 a million. In the case of field crop pests, such as *Pyrausta nubilalis*, Hb., early mass liberations when the host eggs are fairly abundant should, by accelerating field reproduction, bring about early effective parasitism. In the control of orchard pests, such as *C. pomonella*, parasites should be liberated once or twice a week from the time when oviposition begins until after it has reached its maximum, and a sufficient number should be liberated in one season to reduce the population of the host to a point where further liberations would not be required for several years. It is estimated that 10,000–50,000 parasites per tree would bring about this result. In the control of *C. pomonella* an effort will be made to substitute the parasite for the cover sprays of lead arsenate and thus eliminate the problem of arsenical residue.

de Ong (E. R.). **The Characteristics and Uses of Petroleum Oil Sprays.** —*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 144–154, 1 fig., 4 refs. Tring, England, 1929.

The question of the use of oil sprays, their combination with nicotine [*cf. R.A.E.*, A, xvi, 565 ; xvii, 512], their effect on the plant [xvii, 513] and their specifications [xvii, 75] are discussed. The procedure adopted by the California Department of Agriculture for determining the unsulphonatable residue is quoted.

For summer sprays, oils with an unsulphonatable residue of 88–99 per cent. are usually the safest, although oils with high residues are not quite so active as insecticides. The viscosity at 100° F. varies between 40 and 110 seconds Saybolt. The choice of oil is dependent on the species of insect concerned, the time of year and the stage of development of the tree. Newly hatched individuals of *Saissetia oleae*, Bern.

(black scale) are very susceptible to oil and may be controlled with the less viscous forms, but *Chrysomphalus aurantii*, Mask. (red scale) requires the most viscous, non-volatile oil that the tree can tolerate. A viscosity of 50 seconds is the lowest limit that will give 100 per cent. mortality, so that the range should be between 50 and 100 seconds, although injury to the tree may result from use of the latter. The concentrations of oil in the diluted emulsion for these two scales range from 0·8 to 2·0 per cent. Against red spiders (*Paratetranychus* and *Tetranychus* spp.), a viscosity of 50–90 seconds is used, and the oil should be applied a few weeks before the ripening of the fruit. No definite standards have been established for oxidation values and volatility, but the most stable type (that showing the least tendency to oxidation) should be employed. The most volatile oils are usually considered safer than those of a less volatile type.

For dormant spraying, oils containing 65–75 per cent. unsulphonatable residue should be used. The viscosity at 100° F. may range from 65 to 150 seconds, but it should be remembered that viscosity varies greatly at lower temperatures. At temperatures ranging from 45–65° F. in the field, a viscosity of 80 seconds gave better control of *Lecanium corni*, Bch., than those of 60–70 or 100 seconds and above. The oils of higher viscosity are used against armoured scales and leaf-roller eggs. The concentration varies from 2 to 6 per cent., the lower strength being used against young unarmoured scales and eggs of red spider. Spraying should not be undertaken when a tree is suffering from lack of moisture, or at temperatures of 70° F. or above.

Quayle (H. J.). **Developments in the Fumigation of Citrus Trees.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 155–161, 10 refs. Tring, England, 1929.

The history of fumigation of orchard trees, which is practically limited to *Citrus*, and the development of treatment with hydrocyanic acid gas are reviewed. The increased tolerance of certain Coccids to HCN in some districts in California is discussed [*cf.* *R.A.E.*, A, xi, 80; xvi, 118, etc.]. Fumigation is more extensively practised in southern California than in any other part of the world, and in 1927 about 65,000 acres or nearly 6,000,000 trees were treated, at a total cost of about £420,000, or approximately £7 per acre. The most expensive part of the equipment is the tents for covering the trees, of which there are about 20,000, representing an investment of approximately £200,000. Fumigation is not considered satisfactory unless the results are sufficiently effective to last for two years or longer, although under certain conditions annual treatment is required.

Yothers (W. W.) & McBride (O. C.). **Lubricating Oil Emulsions for controlling Insects and Mites on Citrus Trees in Florida.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 165–174, 1 fig., 3 refs. Tring, England, 1929.

The history of the development of oil sprays against *Dialeurodes citri*, Ashm., and *D. citrifolii*, Morg., on *Citrus* in Florida is reviewed. In 1925, experiments were undertaken with oils of different chemical and physical properties at strengths of $1\frac{1}{2}$, 3, 4 and $4\frac{1}{2}$ per cent. The oils were divided into the following three classes according to their toxicity to the trees sprayed; those that could be safely applied at

3, 4 and 4½ per cent. concentrations under all conditions, those that were safe only under certain conditions, and those that caused a certain amount of injury under all conditions. It was found that oils containing an unsulphonatable residue of 70 per cent. or above could be safely applied at 3 and 4½ per cent. ; those with a lower residue usually caused serious defoliation and scorching of the fruit when applied at similar strengths. There is thus a high correlation between injury and the amount of unsaturated hydrocarbons in the oils. Viscosity cannot be employed as an absolute guide in selecting oils that may be safely used on *Citrus*, but oils of a high viscosity are more likely to cause injury than those of a low viscosity. Specific gravity indicates to some extent the nature of an oil, heavy oils being more likely to cause injury than lighter ones, but the sulphonation test appears to be the most satisfactory means of selecting oils for spraying purposes.

Investigations on the concentrations necessary to kill pupae of *D. citri* showed that 1 per cent. is the maximum required and less would probably prove satisfactory. Counts of *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), which is believed to be the most resistant scale on *Citrus* in Florida, showed that a 2 per cent. concentration carefully applied will kill all adult female scales hit by the spray. The concentration required for other insects varies from 1 to 2 per cent. As rust mites [*Phyllocoptes oleivorus*, Ashm.] are only killed when they are hit by the spray, oils are not to be depended on for their control. Oil sprays at 1 per cent. strength, however, are quite satisfactory for the control of *Paratetranychus citri*, McG. (purple mite), being more effective than lime-sulphur.

The limitations in the use of oil sprays and the possibilities of combining them with other insecticides are discussed.

Hinds (W. E.). **The Development of a Control Program for the Mexican Cotton Boll Weevil and some of its Results.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 175–180. Tring, England, 1929.

The history of *Anthonomus grandis*, Boh. (Mexican cotton boll weevil) as a pest of cotton and the development of control measures in the United States are reviewed. Dusting against this pest has been increasingly practised in the southern States during the past 10 years, and poisoning is now considered as essential as the use of improved seed or commercial fertilisers in the profitable production of cotton. At recent prices and costs, it was found that where the " average yield " of one-third bale per acre of cotton is produced, it costs more than 10*d.* per lb. to produce, whereas in districts where the full programme of weevil control and the best cultural measures have been applied, the average yield for the past three years has been practically two bales per acre and the total cost from 2½*d.* to 4½*d.* per lb. It is now possible to produce cotton at a greater profit than before the weevil occurred.

Packard (C. M.). **Hessian Fly Control in the United States.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 181–190, 8 refs. Tring, England, 1929.

The bionomics of *Mayetiola* (*Phytophaga*) *destructor*, Say (Hessian fly) in the main wheat region of the United States are briefly described,

and the value of the various control measures is discussed [*R.A.E.*, A, xi, 413, 497, etc.]. It is suggested that the possibilities of aeroplane dusting and of preventing larval development by producing resistant varieties of wheat should be investigated.

SMITH (H. S.). **The Utilization of Entomophagous Insects in the Control of Citrus Pests.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 191–198. Tring, England, 1929.

In most of the regions of the world where it is grown on a large scale, *Citrus* has been introduced and few of its important pests are indigenous. For this reason biological methods of controlling them are particularly suitable, and an account is given of the introduction into California of various parasites and predators. As most of the Coccids attacking *Citrus* are common to all the leading *Citrus* areas, the value of exchanging information regarding the various entomophagous insects in each country is pointed out.

DEAN (G. A.) & SCHENK (G.). **The Control of Stored Grain and Flour Mill Insects.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 203–228, 2 figs., 16 refs. Tring, England, 1929.

Detailed recommendations are given for the prevention and control of insect damage to stored grain and flour in mills and warehouses in the United States. Information on the use of various fumigants and on the protection of flour from infestation during transit is included.

FRYER (J. C. F.). **The Capsid Pests of Fruit Trees in England.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 227–236, 11 refs. Tring, England, 1929.

An account is given of the bionomics of *Plesiocoris rugicollis*, Fall. (apple Capsid) and *Lygus pabulinus*, L. (common Capsid), two insects that have recently become serious pests of apple in England [*cf.* *R.A.E.*, A, vi, 278; xvi, 619; etc.]. Hypotheses are suggested to explain how these species, each with distinct feeding habits, became adapted to apple. The reaction of food-plants to attack, the tolerance of certain plants and the development of resistance in others are discussed. It has frequently been observed that trees in an orchard permanently covered by grass are less severely attacked by *P. rugicollis* than those grown in cultivated soil, and there is some ground for supposing that the hardier type of growth obtained in grass orchards is less suitable to the bugs both for feeding and oviposition. The present situation regarding the problem of spraying for the control of these pests is reviewed.

COAD (B. R.). **Cotton Insect Problems in the United States.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 241–247. Tring, England, 1929.

Short accounts are given of the more important pests of cotton in the United States and of the measures adopted for their control.

King (K. M.). **The Value of Quantitative Methods in the Investigation of Field Crop Insects, with Special Reference to Work with Wireworms and Cutworms.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928,* ii (Trans.), pp. 248–258, 1 fig., 4 refs. Tring, England, 1929.

The value of studying general insect populations as a means of obtaining information of practical importance in economic entomology is discussed and illustrated by the results secured during 6 years' experience of this method in Canada. The technique employed in procuring representative samples of soil and vegetation is briefly explained. This method may be used to determine the actual amount of damage done by a pest ; to measure the relative effect of various environmental factors on insect and food-plant, since the rate of damage with equal infestation has been found to differ noticeably with cultural, weather, soil, physiological and other variations ; to follow accurately the changes of infestation, both local and general, and to deduce some of the causes ; and to determine the effectiveness of natural control factors, the relative standing of the more important factors both physical and biological, their interrelations, and the conditions limiting each. Where a particular pest is under investigation, supplementary samples may be taken to give a broader and more exact measure of the occurrence and fluctuations of the insect in question during important periods of its development, the studies in this case being only sufficiently detailed to show the numbers of the pest and of its known enemies and competitors without exact reference to the total population. The application of this method to the problems of cutworm and wireworm infestation is given as an illustration [*cf. R.A.E.*, A, xvi, 266].

Britton (W. E.). **The Present Status of the Leopard Moth,** *Zeuzera pyrina* **L., in the United States.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928,* ii (Trans.), pp. 286–289, 4 refs. Tring, England, 1929.

Recent reports on the distribution of *Zeuzera pyrina*, L. (leopard moth) in the United States indicate that it occupies a narrow area extending from the vicinity of Philadelphia along the coast to the northern boundary of Massachusetts and probably not more than 50–60 miles wide. It appears that it is somewhat less destructive to shade trees than it was 10–15 years ago ; on the other hand, it is reported as becoming an important orchard pest in New Jersey [*R.A.E.*, A, xvii, 668]. Brief notes are given on its morphology, life-history and control [*cf. R.A.E.*, A, iv, 281].

McColloch (J. W.) & Hayes (W. P.). **Some Problems in the Control of Underground Insects.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928,* ii (Trans.), pp. 306–315, 21 refs. Tring, England, 1929.

This is a more detailed discussion of some of the problems connected with the control of subterranean insects, a brief outline of which has already been noticed [*R.A.E.*, A, xi, 502]. An investigation of any measure involves a study of its effect not only on the insect, but also on the physical and chemical properties of the soil, on the different types of vegetation and on other biological factors ; the necessity for co-operation between entomologists and workers in other branches of science is therefore apparent.

MUNNS (E. N.) & COVILLE (P.). **Silvicultural Practice in the Control of Forest Insects.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 333–341, 5 refs. Tring, England, 1929.

The authors point out the need for co-operation between forest entomologists, sylviculturists and foresters in dealing with the problems of insects attacking forest trees. Certain conditions in a forest have been, or can be, influenced by sylvicultural management, and research is necessary to determine to what extent alterations in these conditions may be utilised in the control of pests. Of recent years, doubt has been expressed as to the effectiveness of artificial measures used against outbreaks of some of the bark-beetles, as similar epidemics in other localities have suddenly become endemic without the assistance of man. The investigations of the natural factors producing such an effect may result in the discovery of some indirect method of control that may be substituted for the present costly ones. The work of other authors showing the relation of insect attack to such alterable factors as forest density and rate of growth is briefly reviewed, and the possibility of utilising practices such as soil modification, thinning, burning, slash disposal, etc., as means of controlling pests is suggested.

PORTER (B. A.). **The Codling Moth Problem in North America.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 389–396, 4 refs. Tring, England, 1929.

In the United States, the commercial apple crop ranges from 25 to 35 million barrels annually, and the value is estimated at £30,000,000. The gradual change from small farm orchards to large commercial plantings has provided the codling moth [*Cydia pomonella*, L.] with large, practically continuous areas of its preferred food-plant, and owing to the adaptability of the apple to a wide range of climatic conditions, the moth frequently finds itself in a very favourable environment. The history of the development of control measures, which has been coincident with the development of the apple industry, is reviewed. Dissatisfaction with lead arsenate in some sections, owing particularly to spray residue problems and to the fact that certain strains of the pest were found to be more or less resistant to the poison, caused a partial return to the older mechanical means of control, especially banding, and stimulated research with a view to finding a more effective measure. An account is given of investigations that are now in progress and of some of the problems that need further study.

ROSS (W. A.). **Lubricating Oil Sprays and the Pear Psylla Problem.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, pp. 397–400. Tring, England, 1929.

An account is given of the development of oil spraying against the pear psylla [*Psylla pyricola*, Först.] in Canada [*R.A.E.*, A, xiii, 584; xv, 36, 495; xvi, 331]. The formula for the stock emulsion used in Ontario is 1 gal. lubricating oil, 1 gal. water, 2 oz. copper sulphate and 2 oz. hydrated lime.

GRAHAM (S. A.). **The Larch Sawfly and Forestry.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 401–407. Tring, England, 1929.

It has generally been assumed that *Lygaeonematus erichsoni*, Htg. (larch sawfly), which is a serious menace to tamarack [*Larix laricina*] in the swamp forests of the Lake States and eastern Canada, is an introduced insect in America, but evidence of previous periods of reduced growth, as shown by the annual rings in old trees, strongly suggests that it has been present in America for at least a century, and is very likely indigenous.

Experiments made in Michigan showed that mice are the most important enemies of the prepupae in the cocoons during the winter [*R.A.E.*, A, xvi, 511]. Superficial drainage of the swamps increases the variety of ground cover, and is thereby favourable to the mice. On the other hand, observations on the nature of certain swamps in which the trees escaped serious injury during previous outbreaks indicate that excessive water, especially during the spring and early summer, is unfavourable to the sawfly; it is therefore possible that in some instances flooding may offer a practicable means of protecting the trees from injury.

In 1928, field observations were made on the factors affecting the larvae during the feeding period. Heavy rain washed 20–50 per cent. of the first instar larvae from the needles, but less than 10 per cent. of the larvae of the second and later instars were dislodged by a severe storm. Birds and other predators, including Coccinellids and Pentatomids, reduced the number of larvae by about 25 per cent., mainly during the fourth and fifth instars; during the earlier instars the larvae fed on the foliage on slender twigs, where few birds could reach them.

BARNES (T. C.). **An Enquiry concerning the Natural History of the White-pine Weevil** (*Pissodes strobi*). (**Abstract.**)—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 412–413. Tring, England, 1929.

The immature state of the ovarian tubes of recently emerged females of *Pissodes strobi*, Peck, in late summer precludes the possibility of oviposition until spring. The rate of oviposition in cages averaged only 2–4 eggs a day; 150 were laid by one female in May and June in three pine shoots, all of which were killed by the larvae. In pine plantations with a population of 12 females to 100 trees, 25 per cent. of the trees may lose their terminal shoots in a single season. The minimum temperature at which flight occurs is about 70° F. and the optimum 80° F. or above. The weevils leave the pine litter under the trees in the spring when the mean temperature rises from 40 to 60° F. and aestivate when the mean temperature reaches 70° F. in July (Ithaca, New York). Adults have been under observation for two years, but the mortality during the second hibernation is high. Flights occurred during May and June, and the new generation flew readily in August and September. In plantations most flights were made to neighbouring trees, but in an open field a weevil was followed for 100 yards and was last seen 50 ft. in the air, flying with a slight breeze. *P. strobi* is negatively geotropic and positively phototropic, reactions that account for the deposition of eggs at the top of the tree.

The larvae of the facultative predator, *Lonchaea corticis*, Taylor, were abundant in the injured shoots, feeding on the damp frass and attacking many of the pupae of *P. strobi*. The fly was often heavily parasitised by a small Chalcid, *Pleurotropis* sp. The following parasites were reared from the larvae of the weevil: *Eurytoma pissodis*, Gir., which was common, *Labena apicalis*, Cress., *Microbracon pini*, Mues., *Rhopalicus pulchripennis*, Cwfd., *Calliephialtes comstocki*, Cress., *Eupelmus pini*, Taylor, and *Coeloides pissodis*, Ashm. Numerous larvae of a Nematode, *Diplogaster* sp., were observed living symbiotically in the elytra of hibernating weevils and the mature worms were found pairing in injured pine tips. The large weevil populations found on widely spaced trees support the recommendation that pines should be set out with a density not less than 1,500 trees to the acre. The random flights observed in mixtures of pine and deciduous trees help to explain the protection of pines by these trees.

Šámal (J.). *Acalla hastiana* **a Destroyer of Osiers in Czechoslovakia.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 414–415. Tring, England, 1929.

During the last three years the Tortricid, *Peronea* (*Acalla*) *hastiana*, L., has increased to such an extent in various parts of Bohemia that it has become very injurious to willows, and as the basket industry is very important there, the losses are serious. There are two generations a year. The moths rest on the leaves, shoots, etc., during the day and fly in large numbers in the evening. The eggs are deposited singly in the tips of the young osier shoots, 40–60 being laid by one female. The caterpillars web together several leaves at the top of the shoot and feed inside on the youngest leaves and buds, thus arresting growth and lowering the productiveness of the plant. The shoot becomes thin and appears as though frost-bitten or burnt. Pupation takes place within the shelter, and although this species has been reported to overwinter in the adult state, the author has always observed it to hibernate as a pupa. In 1927, 40–60 per cent. of the hibernating pupae of the second generation were parasitised by a small Proctotrupid, but the progeny of the remaining 40 per cent. were sufficiently numerous to cause serious damage. Experimental spraying of willows with a weak arsenical was successful, but the application must be made soon after the larvae hatch and before they are protected by the leaf shelters, the best time being at the beginning of June, or, in the case of the second generation, at the beginning of September.

Fenton (F. A.). **Biological Notes on the Pink Bollworm** (*Pectinophora gossypiella* **Saunders**) **in Texas.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 439–447. Tring, England, 1929.

An account is given of the investigations that are being carried out in Texas on *Platyedra* (*Pectinophora*) *gossypiella*, Saund. (pink bollworm), much of the information having already been noticed [*R.A.E.*, A, xviii, 62]. At Castolon, 96 per cent. of the overwintering long-cycle larvae were found either in the bolls, etc., on the plants or in the rubbish on the ground and 4 per cent. in the soil or on the tap roots. In the rather heavy soil of this locality, which forms a hard crust after irrigation, the movement of the plant stem by the wind causes an opening round the crown, and larvae seeking shelter migrate down

the stem into the soil to the roots. It is not known whether this observation holds good in sandy soils. Larvae may spin either summer or resting-stage cocoons on the tap roots. An account is given of experiments to determine the mortality of long-cycle larvae under irrigation at different times and with different dates of ploughing as well as with combinations of the two. Winter irrigation following winter ploughing proved to be the only effective measure [*loc. cit.*]. The survival of larvae up to 26th June in dried bolls on the plants was greater than in bolls on or in the soil and pupation was delayed, facts indicating that in this locality old standing stalks are dangerous sources of infestation, the winter survival being large and emergence delayed until the cotton plant is in the right stage to be infested. Emergence of moths from bolls on or in the soil extended from 27th March until 2nd July and reached its maximum between 14th and 30th April. According to emergence records, there was a total survival under all conditions of 6·72 per cent.

HOLLOWAY (T. E.). **Local Conditions as influencing Recommendations for the Control of Sugar-cane Insects.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 448–451, 15 refs. Tring, England, 1929.

The author points out, with numerous illustrations, that although some sugar-cane pests are common to many countries, the control measures employed in one country may be impracticable or uneconomic in another. Recommendations must, therefore, be adapted to local conditions and based on an investigation of the particular pest in its native environment.

KING (W. V.). **The Cotton Flea Hopper** (*Psallus seriatus*).—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 452–454, 6 refs. Tring, England, 1929.

The history of the development of *Psallus seriatus*, Reut. (cotton flea-hopper) as a pest of cotton in the United States is briefly reviewed, and the injury caused is described [*cf. R.A.E.*, A, xii, 586 ; xiv, 629, 631 ; xv, 73, 74, 404]. Cotton is not the natural food-plant of this Capsid, and its attack is undoubtedly associated with conditions affecting its more normal food-plants. As a consequence, infestations usually last only a short time, and although in cases of severe attack the entire bottom part of the crop may be destroyed, the plant recovers rapidly after the insects migrate, and the top branches produce normally. Under ordinary conditions of damage by the boll weevil [*Anthonomus grandis*, Boh.], the planter often depends on the early part of the crop before the weevils become numerous, and an almost normal amount of cotton may be produced if no more than an average weevil infestation occurs. If, however, the numbers of early bolls have already been reduced by *P. seriatus*, the losses become much more important.

JABLONOWSKI (J.). **The Black Locust-Tree-Scale,** *Lecanium robiniarum* **Dougl., and the European Corn Borer,** *Pyrausta nubilalis* **Hübn., a Biological Parallel.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 455–462. Tring, England, 1929.

Though attempts are made to prevent the introduction of injurious insects into areas where they do not already occur by quarantine

measures, the possibility that indigenous insects may adapt themselves to introduced plants has been largely overlooked. In this connection the author gives as examples the black locust-tree (*Robinia pseudacacia*) and maize, both of which were introduced from America into Europe, where they were attacked by indigenous insects, the former by *Lecanium corni*, Bch., which had probably migrated from *Cornus*, and the latter by *Pyrausta nubilalis*, Hb., of which the original food-plant was possibly hop. In the latter case, the adapted pest was later introduced into the original home of the maize plant.

Campbell (F. L.) & Filmer (R. S.). **A Quantitative Method of estimating the relative Toxicity of Stomach-poison Insecticides.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 523–533, 1 pl., 1 fig., 11 refs. Tring, England, 1929.

The arsenical residue problem has not only stimulated the search for new stomach poisons, but has emphasised the desirability of comparing their toxicity for mammals and insects. The acute toxicity of poisons for mammals is always expressed in terms of the minimum lethal dose (M.L.D.), *i.e.*, a dose that will kill 50 per cent. of a group of similar animals on a unit weight of animal basis. In order to measure the relative susceptibility of an insect and a mammal to any stomach poison, the respective lethal doses by mouth must be determined and the factor of safety will be the ratio of the M.L.D. for the animal to that for the insect. A method is described for measuring the M.L.D. of relatively insoluble stomach poisons for insects, or, in other words, for administering known doses of these poisons in any desired amount to individual insects. The insects employed were silkworms [*Bombyx mori*, L.], and some of the results were compared with those already obtained by other workers on rabbits. Only two compounds were compared at a time, one of which was always acid lead arsenate as a standard. The method is described by outlining the course of work required to determine the relative toxicity of aluminium arsenate and acid lead arsenate.

Forty 4th instar larvae (mean weight about 0·3 gm.) were weighed individually to 0·1 gm. and placed singly without food in 40 marked Petri dishes, each covered with a dish of the same diameter (to provide a deeper container than the ordinary Petri dish with overlapping lid). The insects were allowed to become hungry for an hour or two while the poisoned food was being prepared. Two ⅞ in. circular cover glasses were weighed to 0·01 mg. and 80 disks of the same diameter were stamped out of selected thin, flat mulberry leaves. The cover glasses were placed in the centre of a 24 cm. square glass plate with 40 leaf disks arranged closely round them, smooth surface upwards. An apparatus is described by means of which a dust cloud of the poison is released under a battery jar, which is then lowered quickly over the plate bearing the leaf disks and cover glasses, coating them with a remarkably fine and uniform deposit of powder. The cover glasses were weighed again, the increase of weight divided by two giving the quantity of acid lead arsenate per leaf disk. About 0·20 mg. per disk or 0·05 mg. per sq. cm. was a satisfactory covering. Each of the untreated disks was then coated with a film of corn starch paste and lowered carefully on to a poisoned disk. The two disks were then pressed together and placed in a Petri dish with a silkworm, the edges

of the sandwich being inserted into a split half cork in order to hold it firmly in a suitable position for feeding. Within 5 minutes most of the larvae began to feed along the margin as though it were a single leaf, and individual doses were varied at will by removing the sandwiches when the larvae had eaten $\frac{1}{8}$ to $\frac{1}{2}$. Usually about 90 per cent. of the larvae had consumed a satisfactory dose in 10–20 mins. Each silkworm was then given a fresh mulberry leaf, and the 40 dishes were placed in an air bath at 27·2° C. [80·96° F.] to await the death or recovery of the larvae. The partly consumed sandwiches were arranged in order on a glass plate 10 by 13 cm., 20 to a plate, with the necessary identification printed on the plate in indian ink. This plate was covered with a similar glass plate, bound at the edges with lantern slide binding and placed in a moist chamber, in which it could be kept as long as a week. The sandwich plates, like photographic negatives, were then printed with enlargement. The method of measuring the amount of leaf consumed and so the amount of arsenic ingested is described. A complete list of the doses administered to determine the relative toxicity of acid lead arsenate and aluminium arsenate is given as an example. The M.L.D. of the former was 0·09 mg. per gm. of silkworm and of the latter 0·9 mg.

The advantages of this method over that used by Janisch [*R.A.E.*, A, xiv, 192] are discussed. The use of sandwiches prevents the larva, while crawling over the leaf, from picking up unknown quantities of the poison on its legs or brushing it off the leaf altogether. In comparison with 7 other compounds, the M.L.D. for acid lead arsenate varied between 0·10 and 0·08 mg. per gm. so that if the deposit of poison is disturbed when making the sandwich, the error is not great enough seriously to affect the results. The chief defect of this and any other leaf area method is that doses cannot be accurately predetermined, and time and insects are wasted in feeding doses that do not help in the delimitation of the M.L.D. It would be desirable to force predetermined doses directly into the alimentary tract of the insect, and although this has been done with solutions [*cf.* xiv, 281], it has not yet been accomplished with suspensions.

The terms effectiveness and toxicity are differentiated ; the toxicity of a stomach-poison refers to its killing capacity in the alimentary tract, and effectiveness also includes factors, such as the concentration, repellency or attractiveness of the poison, that influence the rate of fatality when a poison is available for larval consumption in unlimited quantities. The data from the seven comparative tests are summarised in a table. The most important constant ascertained is the M.L.D. for acid lead arsenate, and the figure should be useful in determining the probable amount of this compound required to kill other insects, even though there may be considerable differences in susceptibility among different species. The toxicity of the other compounds used, *viz.*, copper cyanide, the fluosilicates of sodium, barium and potassium, cryolite (79·8 per cent. 3 NaF,AlF_3), basic lead arsenate and aluminium arsenate, corresponded more or less with their relative effectiveness as determined by field workers. The sample of copper cyanide used was at least twice as toxic to 4th instar silkworms as acid lead arsenate, and the toxicity of pure cuprous cyanide for mammals, insects and plants should be determined before it is discarded as a substitute for lead arsenate. The three fluosilicates and cryolite are known to be as effective or nearly as effective as acid lead arsenate or calcium arsenate, and their relative toxicity is much the same as

their relative effectiveness. Basic lead arsenate and aluminium arsenate were only one-tenth as toxic as acid lead arsenate. The M.L.D. of acid lead arsenate and sodium fluosilicate administered by the mouth were found to be practically the same for the rabbit and the silkworm. It does not appear likely that any inorganic poison will be found to have a high factor of safety for mammals, but a specific stomach poison for insects may be discovered among the more complex organic compounds.

McDonald (R. E.). **Cotton Seed Disinfection as a Control for the Pink Bollworm,** *Pectinophora gossypiella* **Saund.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 552–554. Tring, England, 1929.

Platyedra (*Pectinophora*) *gossypiella,* Saund., was introduced into the part of Texas west of the Pecos River about 10 years ago. In this region cotton is grown, with one exception, in high isolated valleys where the winter is much colder than is usual in cotton producing countries, temperatures of 10° F. being not unusual. No appreciable damage has occurred in these valleys, but in the Big Bend section of the Rio Grande Valley, where the altitude is less and a temperature of 20° F. is regarded as rather low, noticeable injury has been observed though severe damage was confined to a few fields. Many larvae hibernate in the ground or in rubbish on the surface or within old bolls in the field, but the practice of pasturing fields and cleaning up preparatory to planting causes a rather high mortality, which is undoubtedly increased in western Texas by the severity of the winters. The larvae hibernating in stored cotton seed escape the cold, and the control secured in the areas under discussion is certainly due to the disinfection of cotton seed as a continuous process of ginning.

The heating apparatus now most generally employed is described. This is built round the conveyor already in use, and the seed is disinfected in the minute or a little more that elapses between the time it leaves the gin and the time it reaches the loading chute. Where ginning plants are already equipped with steam boilers, the cost probably does not exceed 10*d.* per ton of seed. When climatic conditions permit a higher rate of survival in larvae hibernating outside the seed, it is probable that seed disinfection alone cannot be depended on for complete control.

Newcomer (E. J.). **The Codling Moth in the Pacific Northwest; Status of present Spray Practices and Prospects for Improvements in Control Measures.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 567–570, 8 refs. Tring, England, 1929.

The history of the development of control measures against the codling moth [*Cydia pomonella,* L.] in the Pacific Northwest is briefly outlined. The spray residue problem and the requisite properties of any substitute for lead arsenate sprays are discussed. In the author's opinion lead arsenate will continue to be used in the future in the calyx and early cover sprays in the Pacific Northwest; the fruit will be washed but excessive application of lead arsenate will be avoided. The later sprays will consist of oil, nicotine or some other material that will reduce the residue hazard and the losses from "stings," as these materials will kill the eggs or destroy the larvae before they attempt to enter the fruit. The spray programme will be supplemented

even more than at present by mechanical control measures such as banding and baiting. The problem of the immediate future is to determine the relative value of various insecticides and other methods of control, and to work out the most satisfactory combination of measures.

Burgess (A. F.). **The Control of some imported Tree-defoliating Insects.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 571–578, 6 figs. Tring, England, 1929.

A brief account is given of the introduction into the north-eastern part of the United States of several of the most important insects that defoliate fruit and shade trees. The spread of *Porthetria dispar*, L. (gipsy moth) and the measures taken to control it are reviewed. For more than twenty years, the Federal Government in co-operation with the States concerned has carried on a campaign against this pest, and the annual expenditure has averaged more than £250,000. The area in New Jersey is rapidly being cleared, and the maintenance of the barrier zone in New England and New York, together with the quarantine measures in force have so far protected the States to the west from invasion. The importation of parasites and their successful establishment has helped materially in reducing the pest locally, and over large areas during certain years, but at present gives no assurance of effecting constant control. This work has demonstrated that it is possible and entirely practicable to restrict the spread and reduce the area infested by an insect of this type.

Dudley, jr. (J. E.), Searls (E. M.) & Weed (A.). **Pea Aphid Investigations.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 608–621, 7 figs. Tring, England, 1929.

The following is taken from the authors' summary : Owing to the importance of the pea canning industry in the United States and the injury caused by *Macrosiphum* (*Illinoia*) *pisi*, Kalt. (pea aphis) over a period of three or four years, measures for its control were investigated. Spraying tests were carried out for one year and dusting and sweeping tests for five years. The reduction in infestation varied from zero to approximately 90 per cent. The most uniform results were obtained with a nicotine-copper-lime dust (*e.g.*, 8 lb. nicotine sulphate, 16 lb. monohydrated copper sulphate, 76 lb. lime). The effectiveness of dusting, however, was found to be more dependent on weather conditions at the time of and following treatment than on the strength of material or amount used per acre. The results of all kinds of treatment in terms of yield, grade rate and quality of the canned product could not be correlated with the percentage of control if the factor of plant growth was ignored. In 1924, when weather conditions were particularly unfavourable to the peas, sweeping operations with an aphidozer resulted in a decided increase in yield in every field swept, but since that time neither sweeping nor dusting experiments have resulted in any general increase in yield or income, but have shown a loss. The direct control measures attempted, therefore, have not only been unnecessary but have at times actually been injurious. Plant growth, degree of infestation and mechanical injury, factors that are governed by weather conditions, are more important in determining yield than the particular treatment applied. Natural enemies, comprising nearly 70 species of insects, act as a constant check

on *M. pisi,* but with the exception of the fungus, *Entomophthora aphidis,* have never been observed to control the infestation during the period under study. The seasonal abundance of the Aphid varies greatly from year to year, and has been found to be correlated with the conditions of growth of the peas. Maximum numbers in each season are associated with plant maturity and during the five years of experiment this occurred between 6th and 11th July.

Kuhn (H. A.). **The Problem of Arsenical Residues: Importance of Spray Deposits from the Standpoint of Public Health.** (**Abstract.**)—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 673–674. Tring, England, 1929.

The results of experiments to determine the minimal lethal dose (M.L.D.) of a number of insecticides (including arsenious oxide, calcium arsenite, calcium arsenate, lead arsenate, barium fluoride and sodium fluosilicate) administered by mouth to dogs and rabbits are briefly given. The comparative toxicity of calcium arsenate, of which the M.L.D. was 38 and 50 mg. per kg. of body weight for dogs and rabbits respectively, and sodium fluosilicate, of which the M.L.D. was 150 mg. for dogs and 138 for rabbits, is of interest owing to the increasing use of the latter insecticide. The cumulative effect of sublethal doses of lead arsenate was also investigated, and it was found that the ratio of lead to arsenic in the animal's body was considerably higher than in the original compound, showing that the arsenic was being eliminated and the lead retained. It was evident that rapid death from lead arsenate is due essentially to arsenic, whereas chronic symptoms are due chiefly to lead poisoning. In investigating the residue on fruit sprayed with lead arsenate, the amount of lead and arsenic should be determined, as the small amount of arsenic will probably be less harmful than the lead, on account of the very slow elimination of the latter.

Childs (L.). **The Problem of Arsenical Residues; the Situation in different Apple-growing Areas and Results of Investigations relative to the Production of Apples to meet Market Requirements.** —*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 675–687, 14 refs. Tring, England, 1929.

The circumstances that brought the question of arsenical residue into prominence in 1926 are briefly discussed, and the history of the development of measures to remove such residues from apples in the United States is reviewed. The problem is most serious in the north-western States, where apples are grown in irrigated areas and summer rainfall seldom occurs, and where constant and thorough applications of lead arsenate are necessary to affect control of the codling moth [*Cydia pomonella,* L.]. Within the space of two years, the more important difficulties have been determined, and the packing and handling of a crop valued at between 10 and 15 million pounds sterling have been revolutionised. The investigations undertaken included not only a study of methods for the actual removal of arsenic, but of the physical and physiological effect of such treatments on the fruit, and their influence on its keeping quality. The majority of growers are now convinced that washing with hydrochloric acid is the most satisfactory measure, and many packers believe that this method will not ultimately increase the cost of handling, as the thorough cleaning

of the apples increases the efficiency of the sorters to an extent that will largely offset the costs of treatment. Moreover the appearance of the apples is greatly improved.

Roark (R. C.). **Some recently proposed Stomach Insecticides, a Review of the Patent Literature.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 728–736. Tring, England, 1929.

The purpose of this paper is to stimulate research by calling the attention of entomologists to those classes of materials that seem to offer the greatest promise as stomach insecticides. Some of the compounds of arsenic and fluorine, and a few organic compounds are briefly mentioned, with the numbers of the patents protecting their processes of manufacture. A list is given of moth-proofing materials that have been patented during recent years, as nearly all of them are stomach poisons.

Efflatoun Bey (H. C.). **The Development of Entomological Science in Egypt.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 737–742. Tring, England, 1929.

The history of entomology in Egypt is briefly reviewed, and the work of the different sub-sections of the present Plant Protection Section of the Ministry of Agriculture is described. In Egypt the fauna is of three distinct types: that of the Nile Valley; that of the eastern and western deserts, with the remarkable oases of the latter; and the largely distinct fauna of a narrow belt along the Mediterranean coast, extending westwards almost to Morocco, which is mainly a prolongation of a similar belt found in Palestine. Conditions are favourable for insect control in Egypt owing to the fact that there is practically no rain, the water supply is completely controlled, and the Nile Valley is bordered by a continuous desert area. The intensive cultivation of the fertile region and the immediate proximity of the desert leave little space for the growth of wild plants, of which there are very few species. Many insects, such as *Pyrausta nubilalis*, Hb. (European corn borer) and *Heliothis obsoleta*, F. (American cotton bollworm), that are pests in other countries are not injurious in Egypt.

Rambousek (F. G.). **The Destruction of injurious Insects before the sowing Season of Sugar-beet.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 743–745. Tring, England, 1929.

An account is given of the control measures used against various pests of sugar-beet in Czechoslovakia [*cf. R.A.E.*, A, xv, 168, 316, etc.]. It is pointed out that attacks of *Atomaria linearis*, Steph., can be forecast during the spring floods, as the beetles can be found in the débris brought down by the rivers and distributed over the fields. As this deposit also contains Elaterids and other injurious species, it should be removed while it is still wet. *Opius nitidulator*, Nees, an important parasite of *Pegomyia hyoscyami* var *betae*, Curt., can be easily reared from flies, such as *Lucilia*, *Musca*, etc., and decomposing meat or small dead animals are brought into the fields during cold weather in summer, so that the parasites may find hosts in the maggots feeding on the dead animals and thus be carried over until larvae of *Pegomyia* are again available.

TRÄGÅRDH (I.). **Investigations of the Fauna of a Dying Tree.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 773–780, 9 figs. Tring, England, 1929.

The greater part of the information contained in this paper has already been noticed [*R.A.E.*, A, xv, 271]. The method described of recording the density of attack of different insects that bring about the death of the tree indicates that for each species there is a distinct part of the trunk that presents the optimum conditions for oviposition and possibly for the development of the brood. The diagrams also show the part played by the competition of the different insects in restricting the areas occupied by each. For example, when *Myelophilus* (*Blastophagus*) *minor*, Htg., is present, the attack of *M.* (*B.*) *piniperda*, L., on a pine 46 ft. high ceases at 20 ft., but when the former is absent, the latter will extend its attack on a tree of the same size up to 36 ft.

TRÄGÅRDH (I.). **Studies in the Fauna of the Soil in Swedish Forests.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 781–792, 10 figs., 10 refs. Tring, England, 1929.

The technique employed in investigating the Arthropods inhabiting the soil of forests is described. Oribatid, Gamasid and Trombidiid mites form an essential part of the fauna. Analyses of soil samples from various situations are given, showing the number of mites, Collembola and a few other insects ; and the factors influencing their relative abundance in the different soils and at different depths in the soil are discussed.

[FILIP'EV (I. N.).] FILIPJEV (I. N.). **The Locust Question in Soviet Russia.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 803–812, 1 map. Tring, England, 1929.

An account is given of the distribution and habits of the locusts in the Russian Union, recent work on the subject being reviewed.

[FILIP'EV (I. N.).] FILIPJEV (I. N.). **Life-zones in Russia and their injurious Insects.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 813–820, 3 maps. Tring, England, 1929.

The whole of the Russian Union lies within the Palaearctic region and may be divided into zoogeographic sub-regions and further divided into zones dependent on climatic and ecological factors, soil, etc. These zones are described, and the species of injurious insects that are characteristic of them are briefly discussed.

[PARFENT'EV (I. A.).] PARFENTJEV (I. A.). **Chemical Methods of Insect Control in U.S.S.R.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 836–847. Tring, England, 1929.

The control of injurious insects in the Russian Union has progressed rapidly during the last ten years, and chemical methods are now almost exclusively employed. The quantities of the various insecticides used from 1917 to 1926 are shown in tables, and the methods employed for their application are discussed. Some of the more recent researches

on insecticides are reviewed [*R.A.E.*, A, xiv, 420; xv, 469, 510], but with regard to fumigation with chloropicrin [*cf.* xiv, 57], the author now states that rats fed on bread made from fumigated grain did not increase in weight to the same extent as those fed on bread from unfumigated grain, so that although this insecticide is recommended for the fumigation of empty granaries and stores, and also against household pests, its value as a grain fumigant is doubtful.

[Parfent'ev (I. A.).] Parfentjev (I. A.). **Control of Acrididae in U.S.S.R.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 848–856. Tring, England, 1929.

The methods used for controlling locusts in the Russian Union, including baits, sprays and dusts, are discussed [*cf. R.A.E.*, xvi, 660, 661; xvii, 702, etc.].

[Parfent'ev (I. A.).] Parfentjev (I. A.). **Researches in Insect Toxicology.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 857–864, 1 pl. Tring, England, 1929.

The growing importance of the chemical method of control has led to a detailed study of the action of poisons on insects. The determination of the minimum lethal dose of various arsenicals to cockroaches is discussed [*R.A.E.*, A, xv, 469, 510], and the quantities of arsenical insecticides found in the bodies of poisoned locust nymphs is shown in a table [*R.A.E.*, A, xvi, 661]. A detailed account is given of the digestive tract of a locust and of the changes that occur as a result of arsenical poisoning. Similar changes have also been observed in mosquito larvae (*Aëdes*). It was found that some liquid contact insecticides enter the organism by way of the stigmata and the tracheae, turpentine and soap-solutions being observed in the smallest branches of the tracheal system of cockroaches and Aphids sprayed with these materials.

The susceptibility of various species of insects to insecticides, including fumigants, differs considerably. In experiments with such closely related species as *Calandra oryzae*, L., and *C. granaria*, L., the difference was marked, the former being killed in all cases much more quickly than the latter. Male cockroaches were more easily killed than the females. Age was also found to influence susceptibility, older adults of *C. granaria* being more sensitive to chloropicrin and carbon bisulphide than individuals that had recently emerged. A table is given showing the lethal concentrations of chloropicrin for different stages of various stored product insects and *Tyroglyphus farinae*, DeG., at room temperature with a fumigation of 24 hours, the dosages varying from ·01 to 0·1 per cent. It was found that the susceptibility of the insects investigated depended on their capacity to lose water, the more susceptible species losing more water in 30–40 minutes than the less susceptible when placed in an exsiccator. Dead insects lost more water in the vacuum than live ones, and it is suggested that this fact might be utilised to distinguish dead weevils from those that are merely stupefied by the fumigant, for it was found that individuals of *C. granaria* after being fumigated with insufficient dosages of hydrocyanic acid gas remained in a state of torpor for about two weeks and then revived.

Wakeley (P. C.). **Preliminary Observations on the Pine Tip Moth** (*Rhyacionia frustrana* **Comst.) on Southern Pines.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 865–868. Tring, England, 1929.

Injury by *Rhyacionia frustrana*, Comst. (pine tip moth) was first observed in south-eastern Louisiana in 1921 on young self-sown loblolly pines (*Pinus taeda*). A list is given of the species of pine that have been found to be attacked. Damage by this pest has been reported on southern pines from Texas and Arkansas to Georgia and South Carolina. The moths are usually active on warm bright days, flying within 6½ feet of the ground and running with great rapidity on the foliage and stems on which they alight. All sized trees are attacked, from six-months' old seedlings, barely 6 inches high, to open-grown trees between 19 and 22 ft. high, though the chief injury occurs on trees from 1½ to 8 ft. high. The worst damage observed by the author occurred in extensive pure plantations of *P. taeda*, 3–5 years old, and 1½-8 ft. in height, grown at the rate of about 900 trees to the acre, with no overhead shade and relatively little brush, on sites apparently not well suited to this pine. Pure plantations on favourable sites, although as heavily infested, recovered from the attack and soon passed the stage of greatest injury.

In February and March, in Louisiana, adult moths emerge from pupae overwintering in larval burrows in the pine twigs. In March, the new growth on both leaders and lateral branches of *P. taeda*, *P. echinata*, *P. sondereggeri* and *P. caribaea* begins to show signs of infestation, and by the middle of April about 90–100 per cent. of the new growth of *P. taeda* and a rather lower percentage of that of *P. echinata* and *P. sondereggeri* are infested. *P. caribaea* is much less attacked than the other species and recovers so well that evidence of infestation is sometimes difficult to find. Trees are practically never killed outright by the attacks of *R. frustrana*. There appear to be four generations a year, flights of moths occurring in February–March, May, July and August-September. The injury is characterised by the contorted tips of the dying twigs, which may be covered with dead needles, capped by aborted buds, or obscured by bunches of new growth, and are always marked by old emergence holes and clots of white gum. Clipping and burning of infested tips is economically impracticable, and the most promising method of control appears to be forest management. Planting resistant species such as *P. palustris* and *P. caribaea* is completely effective where it is otherwise practicable, and the damage to *P. taeda* and *P. echinata* may perhaps be reduced by confining these pines to favourable sites, mixing them with resistant species, starting them among brush (*Quercus marilandica* for example) and under an overwood, or using close spacing.

Silvestri (F.). **Preliminary Report on the Citrus Scale-Insects of China.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 897–904. Tring, England, 1929.

Notes are given on the distribution and parasites of 29 species of Coccids attacking *Citrus* in China. Artificial measures are not as a rule necessary for the control of these pests, which are kept in check by their natural enemies, but damage of economic importance is

sometimes caused by *Parlatoria zizyphus*, Lucas, *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), *C. dictyospermi*, Morg., and *C.* (*Aonidiella*) *aurantii*, Mask. *Drosicha contrahens*, Wlk., was attacked by *Cryptochaetum*, a Proctotrupid and *Novius limbatus*, Motsch. ; *Icerya jacobsoni*, Green, by a Prototrupid ; *I. purchasi*, Mask., which was associated with the ant, *Polyrhachis dives*, F. Smith, by *Rodolia* ; *Pseudococcus comstocki*, Kuw., which was also associated with *P. dives*, by a Chalcid (*Anagyrus*), a Proctotrupid, a Cecidomyiid, and species of *Scymnus* ; *P. filamentosus*, Ckll., which was also collected with its parasites in Formosa, by *Anagyrus* and *Scymnus* ; *Ceroplastes floridensis*, Comst., by an Encyrtid ; *Saissetia oleae*, Bern., by *Anysis saissetiae*, Ashm ; *Coccus hesperidum*, L., and *Pulvinaria cellulosa*, Green, by *Coccophagus* and *Microterys* ; *Aspidiotus lataniae*, Sign., by *Aphelinus* and *Chilocorus* ; *Pseudaonidia duplex*, Ckll., by *Aphelinus* and another Chalcid ; *Morganella longispina*, Morg., by a new species of *Archenomus* ; *Chrysomphalus dictyospermi*, *C. ficus* and *C. aurantii* by *Comperiella bifasciata*, How., and *Chilocorus kuwanae*, Silv., *C. dictyospermi* being also attacked by *Aphelinus chrysomphali*, Mercet, *C. ficus* by *A. chrysomphali*, a new species of *Casca* and *Telsimia emarginata*, Chapin, and *C. aurantii* by *T. emarginata*, *Prospaltella aurantii*, How., *Aspidiotiphagus* sp., *Aphelinus* sp., a new species of *Casca* and *Aleurodothrips fasciapennis*, Frankl. ; *Lepidosaphes beckii*, Newm. (which is considered a synonym of *L. pinnaeformis*, Bch.) by *Casca chinensis*, How., *Aphelinus* sp., *Aleurodothrips fasciapennis*, predacious Coccinellids and parasitic fungi ; *L. gloveri*, Pack., by *Prospaltella aurantii* and the same predators as those attacking *L. beckii* ; *Parlatoria zizyphus* by a Chalcid, probably *Aspidiotiphagus lounsburyi*, Berl. & Paoli, and by parasitic fungi ; *P. pergandei*, Comst., by *Prospaltella inquirenda*, Silv., *Aphelinus* sp., and various Coccinellids, such as *Chilocorus* and *Telsimia* ; and *Prontaspis yanonensis*, Kuw., by *Aphelinus* sp. A species of *Eusemion* was bred from *Ceroplastes rubens*, Mask., and *C. ceriferus*, And., and as species of this genus are known to be secondary parasites, there must have been a primary parasite of these two Coccids. *Icerya seychellarum*, Westw., was taken in Indo-china as well as China, and a predatory *Rodolia* was also taken in the former country. Other species observed were *Icerya aegyptiaca*, Doug., *Pseudococcus citri*, Risso, *Prontaspis citri*, Comst., *Pinnaspis* (*Hemichionaspis*) *aspidistrae*, Sign., *Fiorinia theae*, Green, and an unidentified species of *Coccus*. Unfortunately in the Far East, *Comperiella bifasciata* is attacked by *Marietta carnesi*, How., which is sometimes abundant.

Leiby (R. W.). **A Cold Steam Orchard Spraying Machine.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 926–928, 2 figs. Tring, England, 1929.

This machine for applying insecticides in a fine mist by means of steam pressure has already been described [*R.A.E.*, A, xv, 434]. It appears possible to employ with safety a suspended solid or liquid that would cause severe injury if applied to the same foliage with a high-pressure sprayer. For example, sycamore [*Platanus*] trees were treated with pure kerosene without injury to the foliage and with decidedly beneficial effects on the tree.

ADRIANOV (A. P.). **Present Status of Methods and Policy of controlling Insects injurious to Agriculture and Forestry in U.S.S.R.** *4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 964–975. Tring, England, 1929.

The organisation of the work of insect pest control in the Russian Union is described. The chief pests of the more important economic crops and the measures that are being taken for their control are briefly discussed. The entomological periodicals that are at present being published are enumerated, and brief notes are given on the question of supplies of insecticides and apparatus for their application, and on the annual appropriations made by the government and subsidiary organisations for insect control during recent years. The directions in which the work is to be expanded in the future are briefly outlined.

BORODIN (D. N.). **Field Insects of Russia, with Special Reference to Insects introduced into America and their Coefficient of Injury.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 982–991, 3 figs., 4 refs. Tring, England, 1929.

A method for estimating the losses caused by insect pests of economic crops in which the " co-efficient of injury " is determined is briefly outlined [*cf. R.A.E.*, A, xiv, 285]. The character of the injury caused by *Oscinella frit*, L., *Mayetiola destructor*, Say, *Contarinia tritici*, Kirby (wheat midge), *Cephus pygmaeus*, L. (European wheat-stem sawfly) and *Pyrausta nubilalis*, Hb., in Russia, is described, and the co-efficient of injury for these pests is discussed. This co-efficient varies to a certain degree in cases of attack by the same insect on the same species of plant, depending on such factors as the number of larvae to a plant ; it also varies in different localities and in different years, according to the weather, etc. As different varieties of a plant react in different ways to the same insect, plants of the same variety should always be used in determining the co-efficient of injury. A comparative study of the co-efficient of injury for different varieties of a crop, as well as a comparative study of the percentage of infestation, is recommended.

MILLER (J. M.). **The Relation of Windfalls to Bark-beetle Epidemics.** —*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 992–1002, 2 figs., 3 refs. Tring, England, 1929.

The following is largely taken from the author's summary : In trees blown down by wind, part of the root-system remains in the soil and moisture is retained in the inner bark, producing conditions favourable for bark-beetle attack and brood development. Such conditions do not persist for very long in trees that have been cut down. Pine windfalls are particularly attractive to the beetles, and where trees are blown down over large areas, the bark-beetle population may increase to a point where the standing trees on and around the area are attacked. Two outbreaks in California that must have originated largely in fallen trees are described. The period between the overthrow of the trees and the development of the attack on standing timber ranged from two to four seasons. From the fact that the epidemics declined shortly after the healthy trees were invaded, it is

evident that the numbers built up under special conditions cannot be maintained after the beetles attack stands that are not naturally susceptible to infestation. The type and composition of the stand apparently influences its susceptibility to attack, as no epidemic occurred in Douglas fir [*Pseudotsuga taxifolia*], and the outbreak of *Dendroctonus jeffreyi*, Hopk., in Jeffrey pine [*Pinus jeffreyi*] developed much more slowly than that of *D. brevicomis*, Lec., in yellow pine [*Pinus ponderosa*]. Owing to the difficulties involved in treating bark-beetle infestations in fallen trees, control work is only profitable in susceptible stands of high value. In such cases infested trees should be removed before the beetles emerge (provided that means are available for utilising such material), or treated by approved methods if they must be left on the spot. In either case the operations should be completed within two seasons after the windfall occurs.

WEED (C. M.). **Insect Ways.**—Cr. 8vo, xi+325 pp., text ill. New York & London, D. Appleton & Co., 1930. Price 6*s*. net.

The author records in a very popular manner the life-history and habits of a number of the more commonly-known American insects, the book being profusely illustrated throughout the text.

QUAYLE (H. J.). **The Mediterranean and other Fruit Flies.**—*Circ. California Agric. Expt. Sta.*, no. 315, 19 pp., 14 figs., 1 pl. Berkeley, Cal., July 1929.

In view of the possible introduction of the more important fruit-flies into California, where they may become serious pests, the author gives an account of the bionomics of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly), including a list of the food-plants likely to be attacked, and brief notes on the distribution and economic importance of *Dacus oleae*, Gmel. (olive fly), *D.* (*Bactrocera*) *cucurbitae*, Coq. (melon fly), *Anastrepha ludens*, Lw. (Mexican fruit-fly), *A. fraterculus*, Wied. (West Indian fruit-fly), *Rhagoletis pomonella*, Walsh (apple maggot), and *R. cingulata*, Lw., and *R. fausta*, O.S. (cherry fruit-flies). Two species of fruit-fly are already established in California [*R.A.E.*, A, xviii, 20], and *Euxesta notata*, Wied., *Lonchaea occidentalis*, Mall., *Drosophila melanogaster*, Mg. (*ampelophila*, Lw.) and *Carpophilus hemipterus*, L., are associated with decaying fruits.

WILLE (J.). **Insectos perjudiciales que atacan a las papas en el Perú.** [Injurious Insects attacking Potatoes in Peru.]—*La Vida agríc.*, vii, no. 74, pp. 27–32, 4 figs. Lima, January 1930.

Three weevils, *Rhigopsidius tucumanus*, Heller, *Premnotrypes solani*, Pierce, and *Trypopremnon latithorax*, Pierce, attack potatoes in Peru. *R. tucumanus* occurs also in Bolivia and Chile, but the others have been found only in Peru, the more harmful being *P. solani*. The adults feed on the leaves and tubers and oviposit in developing tubers or in the ground. The larvae live in the tubers and pupate there. Potatoes intended for storage or for seed should be fumigated for 48 hours with carbon bisulphide at the rate of 1 pint to 4 cu. ft. space at 18–20° C. [64·4–68° F.].

JABLONOWSKI (J.). **A kukoricamoly magyarországi rovarellenségei és gyakorlati jelentöségük.** [The Parasites of *Pyrausta nubilalis* in Hungary and their practical Importance.]—*Folia ent. hungarica*, i, no. 5, pp. 159–169. Budapest, 1930. (With a Summary in German.)

The work done in recent years by American and European entomologists in connection with the parasites of *Pyrausta nubilalis*, Hb., is reviewed. The author considers that the results obtained confirm his view that the parasites are too few in numbers and species to play any important part in the control of the borer, and that efforts to make use of them would not be practical.

BENCZÚR (E.). **Liliomlevél-fehérítö bogár.** *Aphthona pseudacori* **Marsh.** [*A. coerulea* var. *pseudacori* as a Pest of Iris.]—*Folia ent. hungarica*, i, no. 5, pp. 169–171. Budapest, 1930. (With a Summary in German.)

Whitish stripes on the tips of the leaves of *Iris pseudacorus* are caused by the larvae of *Aphthona coerulea* var. *pseudacori*, Marsh., which mine within them but do not cause any serious damage. The larvae may be crushed *in situ* between the fingers.

JABLONOWSKI (J.) **Egy istállólégy mint nöszirompusztító.** [The Stable Fly as a Pest of Iris.]—*Folia ent. hungarica*, i, no. 5, pp. 171–174. Budapest, 1930. (With a Summary in German.)

For several consecutive years *Muscina stabulans*, Fall., has been observed near Budapest to attack the half opened buds of *Iris*, causing them to rot.

KADOCSA (G.). **A** *Rhyacionia hastana* **Hb. mint virágoskerti kártevö.** [*R. hastana* as a Pest of Flowers.]—*Folia ent. hungarica*, i, no. 5, pp. 174–176. Budapest, 1930. (With a Summary in German.)

At the end of May 1918 numerous larvae of *Rhyacionia hastana*, Hb., a moth that is usually uncommon in Hungary, attacked *Aster amellus* in a garden near Budapest, feeding on the leaves and stems under the cover of a fine web, which also enveloped young shoots and prevented them from blooming. As a control measure, collection of the larvae by means of fine tweezers is recommended. In the case of a heavy outbreak, the plants should be sprayed with a stomach poison early in the spring, before the larvae have begun to spin their webs.

SITOWSKI (L.). **Spostrzezenia nad pasorzytami korników (Ipidae).** [Observations on Parasites of Scolytids.]—*Polsk. Pismo ent.*, ix, pt. 1–2, reprint 13 pp., 1 pl., 14 refs. Lemberg, 1930. (With a Summary in German.)

Notes are given on 22 Hymenopterous parasites reared by the author, chiefly from Scolytids, in various parts of Poland, and on their previously recorded hosts. The Chalcids obtained include: *Rhaphitelus ladenbergi*, Ratz. (previously known as a parasite of *Hylesinus fraxini*,

Panz.) from *Scolytus* (*Eccoptogaster*) *multistriatus*, Marsh. ; *Pteromalus* (*Rhopalicus*) *suspensus*, Ratz., from *Ips typographus*, L., and for the first time from *I. amitinus*, Eichh., and *Hylastes* (*Hylurgops*) *glabratus*, Zett. ; *P. bimaculatus*, Nees, from *Scolytus* (*E.*) *scolytus*, F., and *S. multistriatus*, as many as 70 per cent. of the bark-beetles from certain localities being attacked by this parasite, which is widely distributed in Poland ; *P. brunnicans*, Ratz. (previously known as parasite of *S. scolytus* only) from *S.* (*E.*) *pygmaeus*, F., the rate of parasitism being about 50 per cent. ; *P. capitatus*, Först., from *S. scolytus* and *Pityophthorus micrographus*, L. ; *Rhoptrocerus xylophagarum*, Ratz., from *I. typographus*, *I. amitinus* and *Polygraphus poligraphus*, L. ; *Ipocoelius seitneri*, Ruschka (previously known as a parasite of *I. typographus*) from *I. amitinus*; and *Elachistus leucogramma*, Ratz., observed in galleries of *Scolytus* (*E.*) *ratzeburgi*, Jans., and also reared from *Scolytus* (*E.*) *rugulosus*, Ratz., and *S. multistriatus*, the parasitism reaching 20 per cent. *Eurytoma ischioxanthos*, Ratz., was bred from *I. typographus*, but *E. auricoma*, Mayr, know in the literature as a parasite of *I. sexdentatus*, Börn., *Hylesinus fraxini*, *Myelophilus minor*, Htg., and the weevil, *Magdalis violacea*, L., emerged from the parasites of *S. multistriatus*, which indicates that both these species of *Eurytoma* are hyperparasites.

Of the Braconids, *Coeloides bostrychorum*, Giraud, was abundant in the Tatra mountains in May and June and attacked *I. typographus* and *I. amitinus*. The eggs are deposited singly in the galleries made by the larvae and are swallowed by them while feeding on the wood, the rate of parasitism being sometimes as high as 50 per cent. *C. scolyticida*, Wesm., known as a parasite of *S. scolytus* and *S. multistratus*, was observed ovipositing in larvae of *S. ratzeburgi*. *Dendrosoter middendorfi*, Ratz., proved to be an important parasite of *I. amitinus*, from which it has not previously been recorded, destroying about 30 per cent. Other Braconids were *Microbracon* (*Habrobracon*) *stabilis*, Wesm., bred from *Hylesinus fraxini* and *H. crenatus*, F. ; *Spathius brevicaudis*, Ratz., from *Scolytus multistriatus* ; *S. exarator*, L., from the Anobiids, *Anobium pertinax*, L., and *Xestobium rufovillosum*, DeG. ; *Ecphylus eccoptogastri*, Ratz., from *S. pygmaeus* ; *Eustalocerus clavicornis*, Wesm., from *I. typographus* ; *Calyptus longicaudis*, Ratz., from *S. rugulosus* and *Magdalis ruficornis*, L. ; *Baeacis abietis*, Ratz., from the Anobiid, *Ernobius abietis*, F. ; and *Ichneutes reunitor*, Nees (previously known as a parasite of sawflies) from *I. typographus*.

An Ichneumonid, *Lissonota errabunda*, Holmgr., was obtained from *S. ratzeburgi*.

The economic importance of parasites of bark-beetles is briefly discussed, and the necessity of a study of their biology is emphasised.

[Bugdanov (G. B.).] **Бугданов (Г. Б.). List of agricultural Pests of the Region of Eastern Foothills in the northern Caucasus.** [*In Russian.*]—*Izv. Ingushsk. nauchn.-issled. Inst. Kraev.*, no. 2, pp. 112–130, 5 refs. Vladikavkaz, 1929.

This list of pests of orchards, field crops and stored products observed during 1926–28 includes over 100 insects, and gives notes on their local and seasonal distribution, food-plants and importance, and in some cases on measures for their control.

Papers noticed by Title only.

Toumanoff (K.). **Note sur l'infection des larves d'abeilles par** *Bacillus larvae*.—*Bull. Acad. vét. Fr.*, ii, pp. 45–49, January 1929. (Abstract in *Bull. Inst. Pasteur*, xxviii, no. 2, pp. 85–86. Paris, 31st January 1930.)

Paillot (A.). **Contribution à l'étude des microsporidies parasites de** *Pieris brassicae* **L.**—*Arch. Anat. micr.*, xxv, pp. 212–230, 12 figs., 23 refs. Paris, 1929.

Paillot (A.). **Parasitisme bactérien et symbiose chez l'***Aphis mali* [*A. pomi*].—*C.R. Acad. Sci. Fr.*, cxc, no. 14, pp. 895–896, 1 ref. Paris, 1930.

Paillot (A.). **Sur la spécificité parasitaire des bactéries infectant normalement les pucerons.**—*C.R. Soc. Biol.*, ciii, no. 2, pp. 89–90, 1 fig. Paris, 18th January 1930.

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Wünn (H.). **Zur Coccidenfauna von Württemberg.** [The Coccid Fauna of Wurtemberg.]—*Jhft. Ver. vaterl. Naturk. Württemberg*, lxxxv, pp. 278–280, 1 ref. Stuttgart, 1929.

Thomsen (M.). **Sex-determination in** *Lecanium*.—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 18–24, 3 figs., 6 refs. Tring, England, 1929.

Jarvis (E.). **The Control of Root-eating Scarabaeid Grubs in Queensland Cane-fields.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 25–33, 2 figs. Tring, England, 1929. [*Cf. R.A.E.*, A, xvi, 378, 379, etc.]

Hazelhoff (E. H.). **Biological Control of a Sugar-cane Aphid** [*Oregma lanigera*, Zehnt.] **by transferring its native Parasite** [*Encarsia flavoscutellum*, Zehnt.] **from the old to the young Fields** [in Java].—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 55–61, 3 figs., 4 refs. Tring, England, 1929. [*R.A.E.*, A, xvii, 629, 630, etc.]

Wolcott (G. N.). **Weather and the Non-burning of Trash in Borer** [*Diatraea saccharalis*, F.] **Control in Porto Rico.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 62–64, 1 ref. Tring, England, 1929. [*Cf. R.A.E.*, A, xi, 61, etc.]

Kunhi Kannan (K.). **The Method of controlling the Sugar-cane Borer** [*Diatraea*, etc., in Mysore] **by attracting Adults to Heaps of Trash.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 65–67. Tring, England, 1929. [*Cf. R.A.E.*, A, xii, 381.]

Wolcott (G. N.). **The Pink Bollworm** [*Platyedra gossypiella*, Saund.] **in Haiti.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 68–72, 1 ref. Tring, England, 1929. [*Cf. R.A.E.*, A, xvi, 49.]

Vayssière (P.). **Note complémentaire sur les Coccides Monophléboides.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928*, ii (Trans.), pp. 81–86, 5 figs., 1 ref. Tring, England, 1929. [*Cf. R.A.E.*, A, xiii, 153; xv, 102.]

King (H. H.). **The Pink Bollworm** (*Platyedra gossypiella* **Saunders) in the Sudan.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 90–93. Tring, England, 1929. [*Cf. R.A.E.*, A, xiii, 75; xviii, 100.]

Cleare, jr. (L. D.). **Moth Borer** [*Diatraea* spp.] **Control in British Guiana.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 131–137, 9 refs. Tring, England, 1929. [*Cf. R.A.E.*, A, xi, 113; xiv, 101, 546; xvi, 652.]

Crawford (H. G.). **The European Corn Borer,** *Pyrausta nubilalis* **Hübn., its History and Status as a Problem in the Dominion of Canada.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 138–144, 1 map. Tring, England, 1929. [*Cf. R.A.E.*, A, xvi, 390; xv, 440, etc.]

[Nikol'skiĭ (V. V.).] Nikolsky (V. V.). **The most Important Cotton Insects in Turkestan and the Caucasus.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 162–164. Tring, England, 1929. [*Cf. R.A.E.*, A, xvi, 295; xvii, 3, 289, etc.]

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Caffrey (D. J.). **The European Corn Borer,** *Pyrausta nubilalis,* **Hübn.: Its History and Status as a Problem in the United States.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 294–302. Tring, England, 1929. [*Cf. R.A.E.*, A, xvi, 391; xvii, 377, etc.]

Swezey (O. H.). **The Present Status of certain Insect Pests under Biological Control in Hawaii.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 366–371. Tring, England, 1929. [*See R.A.E.*, A, xvii, 72.]

Middleton (W.). **Factors influencing the Activity of Shade-Tree Insects and the Utilization of these in Control Work.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 374–381, 8 refs. Tring, England, 1929. [*Cf. R.A.E.*, A, xvi, 521.]

Pettey (F. W.). **Codling Moth** [*Cydia pomonella*, L.] **Control and Removal of Spray Residue from Fruit in South Africa.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 382–388, 5 refs. Tring, England, 1929. [*Cf. R.A.E.*, A, xvi, 305, 467, etc.]

Smith (L. B.). **The Japanese Beetle** [*Popillia japonica*, Newm.], **its present Status and Control.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 508–515. Tring, England, 1929. [See *R.A.E.*, A, xviii, 80.]

Stellwaag (F.). *Clysia ambiguella* **Hübn. und** *Polychrosis botrana* **Schiff. im deutschen Weinbaugebiet.** [*C. ambiguella* and *P. botrana* in the German Vine-growing Region.]—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 537–542, 6 figs., 6 refs. Tring, England, 1929. [*Cf. R.A.E.*, A, xiii, 396; xv, 384; xvi, 5, 473, 545.]

Eastham (L. E. S.). **The Post-embryonic Development of** *Phaenoserphus viator* **Hal., a Parasite of the Larva of** *Pterostichus niger* **(Carabidae).**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 546–551, 20 refs. Tring, England, 1929. [*Cf. R.A.E.*, A, xvii, 547.]

SAALAS (U.). **Ueber die Anwendung der Linien-Abschätzung bei der Frequenzbestimmung von Forstinsekten.** [The Use of Linear Estimates (Examination of Material found on Lines crossing in various Directions the Territory surveyed) in determining the Abundance of Forest Insects.]—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 646–656. Tring, England, 1929. [*Cf. R.A.E.*, A, ix, 599.]

[CHORBADZHIEV (P.).] TCHORBADJIEF (P.). **L'entomologie agricole et les insectes nuisibles aux plantes de culture en Bulgarie.** – *4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 746–756, 45 refs. Tring, England, 1929. [*Cf. R.A.E.*, A, xvii, 594.]

[CHORBADZHIEV (P.).] TCHORBADJIEF (P.). **Le coléoptère du colza** (*Entomoscelis adonidis* **Pall., Chrysom.) en Bulgarie.**—*4th Int. Cong. Ent. Ithaca, N.Y. 1928,* ii (Trans.), pp. 768–770, 1 ref. Tring, England, 1929. [*Cf. R.A.E.*, A, xvi, 610 ; xvii, 594.]

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Aclimatación de *Schedius kuwanae* **How. en España.** [The Acclimatisation of *Ooencyrtus kuwanae* in Spain as a Parasite of *Porthetria dispar,* L.]—*Rev. Biol. for. Limnol.,*i (A) , no. 2, p. 116 [no text], 2 figs., 1 map. Madrid, 10th December 1929.

MERCET (R. G.). **Los géneros** *Prochiloneurus* **y** *Achrysopophagus* (**Hym. Chalc.**). [Specific Key to *Achrysopophagus.*]—*Eos,* v, no. 4, pp. 359–363, 2 figs. Madrid, 26th December 1929.

DUSMET Y ALONSO (J. M.). **Los Escólidos de la Península ibérica.** [The Scoliids of Spain and Portugal.]—*Eos,* vi, no. 1, pp. 5–82. Madrid, 10th April 1930.

BONDAR (G.). **Um novo genero e nova especie de pulgões da Bahia (Homoptera, Coccidae, Pseudococcinae).** [*Limacoccus serratus,* gen. et sp. n., on *Attalea,* in Bahia.]—*Bol. biol.,* no. 16, pp. 59–62, 2 pls. S. Paulo, 20th December 1929.

DETTMER (H.). *Ganaspis carvalhoi* **n. sp. (Hymenopt.-Cynipidae). Um novo parasita da mosca das frutas** (*Anastrepha fratercula* **Wied.**). [*G. carvalhoi,* a new Parasite bred from Pupae of the Fruit-fly, *A. fraterculus* in S. Paulo.]—*Bol. biol.,* no. 16, pp. 70–74, 2 figs. S. Paulo, 20th December 1929. (In Portuguese and German.)

HENDEL (F.). **Trypetidae** *in* LINDNER (E.). **Die Fliegen der Palaearktischen Region.** [The Flies of the Palaearctic Region. TRYPETIDAE.]—xlix, Lief. 16–19, 221 pp., 17 pls., 79 figs., 22 refs. Stuttgart, 1927.

Thiéry (A.). **Etudes sur les Buprestides de l'Afrique du Nord.** [With alphabetical List of Food-plants.]—*Mém. Soc. Sci. nat. Maroc*, xix, 586 pp., 2 pls., 29 maps, 167 figs. Rabat, 31st December 1928.

Fisher (W. S.). **Notes on Leaf-mining Buprestidae (Coleoptera),** [from Panama] **with Descriptions of New Species.**—*Proc. Ent. Soc. Wash.*, xxxi, no. 9, pp. 177–182. Washington, D.C., December 1929.

Böving (A. G.). **Taxonomic Characters for the Identification of the mature Larvae of** *Pissodes strobi* **Peck and** *Pissodes approximatus* **Hopkins (Fam. Curculionidae).**—*Proc. Ent. Soc. Wash.*, xxxi, no. 9, pp. 182–187, 1 pl., 3 figs. Washington, D.C., December 1929.

Trägårdh (I.). **Undersökningar över den större Snytbaggen ogh dess Bekämpende.** [Studies of *Hylobius abietis*, L., and its Control.]—*Medd. Skogsförsöksanst.*, no. 25, pp. 29–92, 26 figs., 22 refs. Stockholm, 1929. (With Summary in German.) [*Cf. R.A.E.*, A, xvii, 658.]

Schwarz (M.). **Die Organisation und Durchführung der Bekämpfung des Kartoffelkäfers in Frankreich.** [The Organisation and Execution of Work against the Potato Beetle (*Leptinotarsa decemlineata*, Say) in France.]—*NachrBl. deuts. PflSchDienst.*, x, no. 2, pp. 9–11. Berlin, February 1930. [*Cf. R.A.E.*, A, xvii, 639, etc.]

Friederichs (K.) & Steiner (P.). **Licht und Insektenentwicklung.** [Light and Insect Development. Experiments with *Melasoma aenea*, L., and *Pieris brassicae*, L.]—*Zbl. Bakt.*, (2) lxxx, no. 1–7, pp. 71–77. Jena, 22nd January 1930.

Wellington (R.), Stout (A. B.), Einset (O.) & Van Alstyne (L. M.). **Pollination of Fruit Trees.**—*Bull. N.Y. State Agric. Expt. Sta.*, no. 577, 54 pp., 9 tables, 7 figs., 49 refs. Geneva, N.Y., November 1929.

Allman (S. L.). **Studies of the Anatomy and Histology of the reproductive System of the Female Codling Moth,** [*Cydia*] *Carpocapsa pomonella* **(Linn.).**—*Univ. Calif. Pub. Ent.*, v, no. 7, pp. 135–164, 5 pls., 9 figs., 19 refs. Berkeley, Cal., 1930.

Poulton (E. B.). **British Insectivorous Bats and their Prey.**—*Proc. Zool. Soc. Lond.*, 1929, pt. 2, pp. 277–303, 67 refs. London, August 1929.

[Bugdanov (G. B.).] **Бугданов (Г. Б.). Russian Literature on injurious Acrididae.** [*In Russian.*]—8vo, 49 pp. Vladikavkaz, Sta. Zashch. Rast. pri Gorsk. s.-kh. Inst., 1929. [Bibliography of 950 titles.]

Ainslie (C. N.). **The Western Grass-stem Sawfly** [*Cephus cinctus*, Nort.] **a Pest of Small Grains.**—*Tech. Bull. U.S. Dept. Agric.*, no. 157, 23 pp., 16 figs., 6 refs. Washington, D.C., November 1929. [Revision of Dept. Bull. 841, *R.A.E.*, A, viii, 464.]

Colcord (M.), Hawes (I. L.) & Carabelli (A. J.). **Check List of Publications on Entomology issued by the United States Department of Agriculture through 1927** [up to 1927 inclusive], **with Subject Index.**—*Bibliogr. Contr. U.S. Dept. Agric.*, no. 20, iv+261 pp., multigraph. Washington, D.C., January 1930.

Roark (R. C.). **Review of United States Patents relating to Pest Control** [issued July-December 1929].—ii, nos. 7–12; 9, 11, 9, 14, 11, 17 pp. multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Chemistry & Soils, 1929.

[BUGDANOV (G. B.).] **Бугданов (Г. Б.). Current Problems of Plant Protection from agricultural Pests in Ingushiya and Osetiya.** [*In Russian.*]—*Izv. Gorsk. s.-khoz. Inst.*, no. 6, pp. 147–157, 4 refs. Vladikavkaz, 1929. (With a Summary in German.)

Brief notes are given on the chief field and orchard pests observed in the northern Caucasus from 1922 to 1928, which are responsible for an annual loss of 10–40 per cent. of the ultimate crop, and on those infesting stored products, and a programme for the organisation of measures against them is outlined.

[ZUBAREVA (S. P.). **Зубарева (С. П.). The statistical Evaluation of the Method of quantitative entomological Sweeping.** [*In Russian.*] —*Izv. biol. nauchn.-issled. Inst. biol. Stantz. Perm.*, vii, no. 2, pp. 89–104, 2 figs., 12 refs. Perm, 1930. (With a Summary in English.)

The use of a sweeping net for quantitative studies of insect communities is discussed. The results obtained showed that different persons usually catch different numbers of insects ; consequently their catches cannot be compared directly, without a knowledge of their respective personal coefficients. The method can only be considered of value if it has been found that all the workers make collections of a constant type.

[YAKHONTOV (V. V.).] **Яхонтов (В. В.). The "Fork" Deformation in Cotton Plants, its Cause, Nature and Effect on the Plant.** [*In Russian.*]—8vo, 5 pp., 4 figs., 4 refs. Tashkent, Glavn. Khlopkov. Komitet, 1929.

A peculiar deformation of cotton, recorded from various parts of Turkestan and observed by the author in the Bokhara region, is described. The seedlings show an excessive development of the cotyledons, the surface of each of which is often 16·7 sq. cm. [2·6 sq. ins.], and the axillary bud falls off. Observations indicated that it results from infestation of the bud by *Aphis gossypii*, Glov., *A. laburni*, Kalt., *Macrosiphum* (*Acyrthosiphon*) *gossypii*, Mordv., or *Thrips tabaci*, Lind., or from its destruction by biting insects, such as *Longitarsus pellucidus*, Foudr. The injury is fatal only when the plant is also infested at the top of the roots by soil pests, those observed including various Colepotera, *Feltia exclamationis*, L., and *Euxoa segetum*, Schiff. In 1928 there were numerous cases in which the deformation was solely due to infestation by *Hypera* (*Phytonomus*) *variabilis*, Hbst. (lucerne weevil), which injured the buds and tops of the roots of the cotton seedlings.

If the top of the roots is free from infestation, the injury caused to the axillary bud usually results in the formation of a new one in 3–8 days, and should this new bud be destroyed as well, a third one is produced in 3–13 days, and the plant recovers. Sometimes two new buds are formed giving rise to two independent stems. Injury to the top of the roots only does not produce any deformation. The physiological processes occurring in the injured plants are discussed in detail.

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Laing (F.). **Descriptions of new, and some Notes on old, Species of Coccidae.**—*Ann. Mag. Nat. Hist.*, (10) iv, no. 23, pp. 465–501, 28 figs. London, November 1929.

The new Coccids described include: *Asterolecanium hancocki*, *Pseudococcus bukobensis* and *P. njalensis* on coffee in Uganda, Tanganyika Territory and Sierra Leone respectively; *Phenacoccus latipes* var. *slavonicus*, n., on barley in Odessa, Ukraine; *P. phaseoli* on dwarf beans in Sierra Leone; *Ctenochiton arborescens* on *Tabernaemontana* sp., in San Thomé, on an undetermined plant in Kenya Colony, and on various species of *Coffea* in the Gold Coast, Tanganyika Territory, Uganda and Anglo-Egyptian Sudan; *Chionaspis ritchiei* on coffee in Tanganyika Territory and Sierra Leone; *Fiorinia fletcheri* on *Aegle marmelos*, and *Chrysomphalus* (*Aonidiella*) *misrae* on *Tamarindus indica*, in Pusa, India; *Selenaspidus spinosus* on banana in Sierra Leone; and *Lepidosaphes punicae* on pomegranate (*Punica granatum*) in Tanganyika Territory.

Phenacoccus trinidadensis, Laing [*R.A.E.*, A, xiii, 420] is considered a synonym of *Puto barberi*, Ckll., and *Dinaspis annae*, Mal., a synonym of *Prontaspis* (*Chionaspis*) *citri*, Comst., which is the type of the genus *Prontaspis*. The author discusses the variation and distribution of *Chrysomphalus rossi*, Mask., and describes two varieties, *viz.*, var. *musae*, n., on banana in Tanganyika Territory and var. *colae*, n., on kola [*Cola acuminata*] in Sierra Leone. *Aspidiotus* (*Targionia*) *sacchari*, Ckll., the generic position of which is discussed, is recorded from sugar-cane and grasses in Jamaica, sugar-cane in British Guiana, and coconut and other plants in Sierra Leone, and *Pseudaonidia baikeae*, Newst., from kola in Sierra Leone.

Malenotti (E.). **La lotta contro la filossera gallecola in Ungheria e in Romania.** [Measures against gall-forming *Phylloxera* in Hungary and in Rumania.]—*Italia vinic. agrar.*, xx, no. 2, pp. 23–25. Casale Monferrato, 12th January 1930.

In Transsylvania and South Hungary infestation of the leaves of vines by the gall-producing forms of *Phylloxera* is very slight owing to the adoption of Börner's method of keeping the old stock covered with an 8-inch layer of soil from the end of July to early October, thus preventing oviposition by the sexuparae and sexed females [*cf.* *R.A.E.*, A, xiv, 563]. This is supplemented by the removal in the following year of the young leaves bearing galls of the first and second generations. Success in preventing oviposition on the old wood depends on the compactness of the soil and on the correct date of application. At Medias, Transsylvania, this method has been varied by F. Càspari, who endeavours to prevent the emergence from the ground of the fundatrix larvae from the winter eggs, imprisoning them by covering the old wood in March instead of at the end of July. In Italy, Topi recommends the burial of the stocks in winter, with the object of causing the winter eggs to rot [xvi, 470].

Miles (H. W.). **The Chrysanthemum Midge,** *Diarthronomyia hypogaea* **F. Lw.**—*North Western Nat.*, iv, no. 4, pp. 173–175, 1 pl., 3 refs. Arbroath, December 1929.

Notes are given on the bionomics of *Diarthronomyia hypogaea*, F. Lw., which was found attacking chrysanthemums under glass in

Hertfordshire and Essex in 1927, and in Lancashire in 1928 [*cf.* *R.A.E.*, A, xvi, 10, etc.].

Spraying with 98 per cent. nicotine at the rate of 2 oz. in 25 gals. water with soft soap to lather, while the adults are emerging and ovipositing, gives successful control [*cf.* xvii, 406].

Hughes (A. W. McK.). **Aphis as a possible Vector of "Breaking" in Tulip Species.**—*Ann. Appl. Biol.*, xvii, no. 1, pp. 36–42, 1 pl., 8 refs. Cambridge, February 1930.

An account is given of preliminary experiments carried out in Surrey from November 1928 to March 1929 to discover the vector of the virus that causes a transmissible variegation in tulips known as "breaking," in which the flowers show white streaks or streaks that are darker than the normal colour, both types sometimes occurring in a single flower. Four species of Aphids that are known to attack tulips were employed, *viz.*, *Anuraphis tulipae*, Boy., which chiefly infests the bulbs but sometimes feeds on the foliage, *Rhopalosiphoninus tulipaella*, Theo., which feeds both on bulbs and foliage, *Macrosiphum gei*, Koch, which infests the foliage and flowers, and *Myzus persicae*, Sulz., which attacks the foliage. No "breaking" occurred in flowers grown from bulbs artificially infested with *A. tulipae* and *R. tulipaella* that had previously fed on infected bulbs. In the case of *Macrosiphum gei* and *Myzus persicae*, which were transferred to the foliage of healthy tulips, the former from young shoots and the latter from foliage of infected plants, the percentages of definite "breaks" were 5·6 and 25 respectively. The form with dark red streaks seemed to be very closely associated with *M. persicae*, and that with white streaks with *M. gei*. It is possible that more than one virus may be concerned.

MacGill (E. I.). **The Biology of Thysanoptera, with Reference to the Cotton Plant. v. The Relation between the Degree of Infestation and the Type of Soil.**—*Ann. Appl. Biol.*, xvii, no. 1, pp. 150–161, 7 figs., 9 refs. Cambridge, February 1930.

In continuation of previous studies [*R.A.E.*, A, xvii, 497], experiments were carried out to determine the effect of different types of soil on infestation of cotton by *Thrips tabaci*, Lind. The literature on the subject is briefly reviewed. The following is taken from the author's summary: The types of soil used were a heavy clay soil and a light soil with less than 15 per cent. of clay, about 50 pots being filled with each type. Each block of 50 plants was divided into two, the soil in one-half being tilled, and in the other left undisturbed. The plants in untilled clay soil were least infested, and those in light, tilled soil were the most highly infested. The average infestation of the two blocks with light soil was slightly higher than that of the clay soil blocks, in spite of the fact that at the beginning of the season the former blocks of plants and the thrips on them suffered severely from a sudden rise in temperature. In each type of soil the block with tilled soil was more highly infested than the other. It appears, therefore, that light soil is more favourable to the multiplication of soil-pupating species of thrips than an easily caking, clay soil, and that tillage increases the infestation.

Baudys (E.). **Znetvoreni pupenu rybizu.** [The Deformation of Buds of *Ribes.*]—*Prakticky rádce,* xxiii, reprint 2 pp., 1 fig., 1928. (Abstract in *Neuheiten PflSchutzes,* 1929, no. 5, p. 20. Vienna, December 1929.)

In Moravia the mite, *Eriophyes ribis,* Nal., has been spreading on currants and on the ornamental *Ribes alpinum.* Up to 3,000 mites and eggs may occur in a swelling bud. In May they infest the flowers and leaves, and from June onwards the new buds, where they oviposit in August. On gooseberry the mites live only beneath the bud-scales, which become swollen. The removal of infested buds and spraying with carbolineum, etc., from December to February, are the measures suggested.

Horn (—). **Erfahrungen und Beobachtungen in der gemeinsamen Frostnachtspannerbekämpfung.** [Experiences and Observations in co-operative Work against the Winter Moth.]—*Geisenheimer Mitt. Obst- u. Gartenbau,* xliii, no. 10, p. 165, 1928. (Abstract in *Neuheiten PflSchutzes,* 1929, no. 5, p. 22. Vienna, December 1929.)

The use of adhesive bands against the winter moth [*Cheimatobia brumata,* L.] is compulsory in the neighbourhood of Wiesbaden. As the female moths, when crawling up the trees, often turn back on reaching the adhesive, it is advisable not to apply it for a few inches along the lower edge of the paper band. The eggs will then be laid on this part of the band and will be destroyed when it is burnt.

Wellenstein (G.). **Beiträge zur Systematik und Biologie der Rindenläuse (Lachninae C.B.)** [Contributions to the Classification and Biology of Bark Aphids.]—*Z. Morph. Oekol. Tiere,* xvii, no. 4, pp. 737–767, 22 figs., 17 refs. Berlin, 17th April 1930.

A general account is given of the life-history of the Lachninae, and two new species, *Neochmosis* (*Dilachnus*) *radicicolus* and *N.* (*D.*) *pubescens,* are described from Germany. The former lays its eggs in spring on the needles of spruce (*Picea excelsa*), on which the fundatrices and the three following generations live. Winged females appear in June. During late summer and in autumn the Aphids live on the roots of spruce, *Calluna vulgaris* and beech. In September–November the young sexual forms leave the roots and climb up the trunk, where fertilisation occurs. The biology of *N. pubescens* is in some respects similar, but the eggs are laid on the twigs of *Abies pectinata.* Winged males are found only in small numbers on the roots, nymphs being more frequent. Towards the middle of October the sexual individuals leave the roots and trunk and oviposit in the crown of the tree. Both species appear to feed only in late summer and in autumn.

Escherich (G. U.). **Ein multipler Thermohygrostat mit ständiger Lufterneuerung.** [A multiple Thermohygrostat with a constantly renewed Air Supply.]—*Anz. Schädlingsk.,* vi, no. 2, pp. 13–14, 1 fig., 2 refs. Berlin, 15th February 1930.

In this apparatus the breeding chambers are heated by a current of warmed air, the temperature and moisture of which can be regulated.

They consist of the glasses of electric light bulbs, which are placed upside down on a cork mat through which the air entrance and exit tubes pass. The rate of flow of the air, which is supplied by an electric blower containing heating elements, can be regulated from outside each chamber, and each contains a thermometer and hygrometer.

v. Butovitsch (V.). **Zur Kenntnis des *Ips cembrae* Heer.** [A Contribution to the Knowledge of *I. cembrae*.]—*Anz. Schädlingsk.*, vi, no. 2, pp. 15–17. Berlin, 15th February 1930.

A detailed account is given of observations in the Prussian province of Saxony on the feeding by *Ips cembrae*, Heer, on larch twigs [*cf.* *R.A.E.*, A, xiv, 434]. It is confirmed that this is nutritional and not maturation feeding. Large twigs are injured as well as small ones, but the mining is noticeable only in the latter, because they are broken off by wind.

Helm (A.). **Ein Schädling der Malven.** [A Pest of Hollyhocks.]—*Anz. Schädlingsk.*, vi, no. 2, pp. 21–22. Berlin, 15th February 1930.

The larvae of *Gelechia malvella*, Hb., are recorded as infesting the seed-capsules of hollyhock (*Althaea*) in Saxony.

Zacher (F.). **Ein neu eingeschleppter Vorratsschädling,** *Anthrenus fasciatus* **Hrbst.** [*A. fasciatus*, a Store Pest newly introduced into Germany.]—*Mitt. Ges. Vorratsschutz*, vi, no. 1, pp. 1–2. Berlin, January 1930.

Living adults and larvae of *Anthrenus fasciatus*, Hbst., which had not previously been recorded in Germany, were found in a fur from north-eastern Asia. As this beetle does not occur there, the fur must have become infested during the sea voyage.

Seidel (J.). **Beobachtungen an Hausschädlingen.** [Observations on Household Pests.]—*Mitt. Ges. Vorratsschutz*, vi, no. 1, pp. 2–9, 4 figs. Berlin, January 1930.

Records made in Prussian Silesia of pests of stored products occurring in unusual food materials include larvae and adults of the flour beetle, *Tenebrio molitor*, L., on dried apples and pears ; *Sitodrepa panicea*, L., in wheat poisoned with strychnine for destroying mice, larvae and pupae being found within the grains and adults in the container ; larvae of the grain moth, *Tinea granella*, L., feeding in cigars ; and those of the meal moth, *Ephestia kühniella*, Zell., infesting stored acorns.

Bischoff (H.). **Ueber einen eigenartigen Fall von Tabak-Entwertung durch eine Lehmwespe.** [On a singular Case of Depreciation of the Value of Tobacco by a Mud-wasp.]—*Mitt. Ges. Vorratsschutz*, vi, no. 1, pp. 9–10. Berlin, January 1930.

Tobacco leaves imported into Danzig from Kentucky were found to have lumps of clay adhering to them, some of which contained larvae

of a mud-wasp of the genus *Sceliphron*. It is probable that the infestation occurred when the leaves were drying or were in the store-sheds. Some 400 lb. of leaves was rendered unusable.

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*NachrBl. deuts. PflSchDienst.*, Beilage ii, no. 5, pp. 201–248. Berlin, 1st March 1930.

This part includes regulations restricting the importation of cactus plants and fresh fruit into Germany as a precaution against the San José scale [*Aspidiotus perniciosus*, Comst.].

v. Tubeuf (C.). **Nadelverlust der Kiefer.** [Loss of Needles in Pines.] —*Forstl. WSchr. Silva*, xvii, p. 326, 1929. (Abstract in *Zbl. Bakt.* (2) lxxx, no. 8–14, pp. 315–316. Jena, 20th February 1930.)

In 1928 an infestation of pines by the gall-midge, *Thecodiplosis* (*Diplosis*) *brachyntera*, Schwaegr., the weevil, *Brachonyx pineti*, Payk., and *Luperus* (*Galeruca*) *pinicola*, Duft., was observed in Bavaria, the upper shoots losing their needles. Owing to various factors, including the Hymenopterous parasite, *Calliceras* (*Ceraphron*) *brachynteri*, Schwaegr., the trouble is not likely to continue.

Wolff (—). **Rüsselkäferbekämpfung mit Arsen.** [Weevil Control with Arsenic.]—*Forstl. WSchr. Silva*, xvii, pp. 313–315, 1929. (Abstract in *Zbl. Bakt.* (2) lxxx, no. 8–14, p. 316. Jena, 20th February 1930.)

The method advised against *Hylobius abietis*, L., is the uniform distribution over the entire infested area of barked twigs tied in bundles and laid in holes of sufficient depth. The twigs must be fresh enough to smell of resin and must be dusted with calcium arsenate. The weevils die about fourteen days after ingesting the poison. In large spruce forests the dusted twigs should be placed under poisoned pieces of bark. Direct dusting of the trees themselves should be practised only in the case of restocked pine or young spruce plantations.

Kindt (S.). **Et Middel mod** *Hylobius abietis*. [A Measure against *H. abietis*.]—*Dansk Skovforen. Tidsskr.*, 1928, pp. 242–243. (Abstract in *Zbl. Bakt.* (2) lxxx, no. 8–14, p. 316. Jena, 20th February 1930.)

In Denmark an area of conifers infested by *Hylobius abietis*, L., may be replanted only after four years, because the weevil appears in abundance on clear-felled areas. It may be repelled by strewing powdered naphthalene on the ground round the stem of each seedling. This material is not affected by rain.

Goesch (—). **Kiefernspannerbekämpfung durch Bodenfeuer.** [Pine Moth Control by Burning over the Ground.]—*Deuts. Forstw.*, xi, p. 69, 1929.

Wendt (—). **Zu: Kieferspannerbekämpfung.** [The Control of the Pine Moth.]—*T.c.*, pp. 139–140.

GUDERIAN (—). **Spannerbekämpfung durch Abbrennen der Bodendecke.** [Pine Moth Control by Burning the Ground Litter.]—*T.c.*, pp. 573–575.

v. GRÜNBERG (—). **Spannerbekämpfung durch Brennen.** [Pine Moth Control by Burning.]—*T.c.*, pp. 602–603. (Abstract in *Zbl. Bakt.* (2) lxxx, no. 8–14, pp. 316–317. Jena, 20th February 1930.)

Goesch states that the practice of burning the ground litter in order to combat the pine moth [*Bupalus piniarius*, L.] dates from 1869. According to Wendt, burning is possible only in old stands with tall trees. There must be no wind, tall grass or undergrowth, because of the risk of the fire getting out of control. Only the uppermost layer is burnt, but about 80 per cent. of the pupae are destroyed. Guderian states that about 90 per cent. of the pupae are killed, and the same figure was obtained by v. Grünberg. One-year-old pines grew well when planted in the ash-covered ground.

MALENOTTI (E.). **Esperienze contro le grillotalpe in autunno.** [Experiments against Mole-crickets in Autumn.]—*Il Coltivatore*, 1930, no. 4, reprint 8 pp. Casale Monferrato, 1930.

Laboratory experiments to test the value at autumn temperatures of the bait of broken rice and zinc phosphide [*R.A.E.*, A, xviii, 45] against mole-crickets [*Gryllotalpa gryllotalpa*, L.] showed that the insects survived for over 7 days at 15° C. [59° F.], though they were killed within 3 days at 21°—32° C. [69·8°—89·6 ° F.]. The bait was preferred to fresh lettuce, which is a favourite food of these crickets. Field experiments showed that the poison is eventually as effective in autumn as in summer, but about a fortnight is needed for death to ensue.

Recent Attainments and Perspectives in Agronomy. [*In Russian.*]—Roy. 8vo, 76 pp., 15 figs. Leningrad, State Inst. Exptl. Agron., 1929. Price, 60 *kop.*

This publication comprises four papers.

In " Some Regularities in Distribution and Propagation of gregarious noxious Insects," by I. N. Filip'ev (pp. 1–24, 12 figs., 2 pp. refs.) the causes of the outbreaks of such common pests in Russia and elsewhere as *Pieris brassicae*, L., *Locusta migratoria*, L., *Calliptamus italicus*, L., *Euxoa* (*Feltia*) *segetum*, Schiff., *Porthetria dispar*, L., and *Phylloxera* are reviewed. The ecological factors regulating them include the temperature and humidity of the air and soil, fluctuations of meteorological conditions in a given area, composition of the soil, predominant type of vegetation, disturbance of the balance of nature by the activities of man, crop rotation, the diseases and parasites of the pests, and the direct control of the latter by means of chemical, agricultural or mechanical measures. The importance of a study of these factors in order to be able to predict potential outbreaks of pests and organise means of control at the appropriate time and on a sufficiently large scale is emphasised.

A. D. Petrov's paper, " Chemical Method of Control of noxious Insects in Agriculture" (pp. 25–38, 7 refs.), is a review of recent progress in the development of insecticides against pests of economic plants and stored products, the properties and uses of various fumigants, sprays

and dusts being discussed. The work to be undertaken in Russia in connection with the manufacture of insecticides is outlined.

"The Biological Method of Control of noxious Insects," by N. F. Meĭer (pp. 39–48, 3 figs., 27 refs.) is an amplified review of the subject [*cf. R.A.E.*, A, xi, 141], and contains a discussion on the immunity of individual eggs and larvae of a given host from parasitism [xii, 39; xiii, 543].

A. N. Rakhmaninov contributes a paper entitled "Agricultural Method of Control of noxious Insects" (pp. 49–76, 49 refs.), which is an extensive review, chiefly of Russian literature, of the effect of cultural practices on pests of cereals, flax and other crops, including the date and density of sowing, clean cultivation of the fallow, deep ploughing, manuring and crop rotation, and, in case of clover, early mowing.

[LEBEDEV (O.) [A.] & SAVENKOV (O.) [A.] **Лебедев (О.) [А.] и Савенков (О.) [А.] Einige neue Ergebnisse aus der Biologie und Physiologie des Kieferspinners** (*Dendrolimus pini* **L.**). [A few new Data on the Biology and Physiology of *D. pini*.] [*In Ukrainian.*]—*Zap. Kiiv. sil.-gospod. Inst.*, iv, pp. 37–50. Kiev, 1929.

This is an account of laboratory and field observations on *Dendrolimus pini*, L., on pine carried out near Kiev in 1928. The emergence and flight of the adults [*R.A.E.*, A, xvii, 138] and their mating habits are discussed. Although at the beginning of the flight period the males were more than three times as numerous as the females, in the second half of the period their numbers became equal. Mating has no effect on the duration of life of males, which averages 17 days, whereas it shortens the life of females, reducing it to 9–11 days as compared to 10–20. In three experiments out of four, 90–100 per cent. of the eggs hatched. Their vitality probably depends on the condition of the adults; eggs of the first batches are larger in size and develop more slowly than those laid later. Hatching of the eggs of one batch may cover a period of 3–4 days.

Over 38 per cent. of the pupae of *D. pini* collected in a forest were infested with Dipterous parasites, those obtained, in order of their abundance, being *Tachina larvarum*, L., *T. fallax*, Mg., *Sarcophaga* (*Agria*) *affinis*, Fall., *Sturmia inconspicua*, Mg. (*bimaculata*, Htg.), and *Pollenia rudis*, F.

HERING (M.). **Eine neue** *Lithocolletis* **als Schädling an Apfelbäumen (Lep.).** [A new *Lithocolletis* as a Pest of Apple.]—*Mitt. deuts. ent. Ges.*, i, no. 4, pp. 62–64, 3 figs. Berlin, April 1930.

Lithocolletis gerasimowi, sp. n., was found mining in the lower surface of leaves of apple near Moscow. Pupation takes place in the mines.

TRENCH (A. D. Le Poer) & ANDERSON (T. J.). **A Report on the Campaign against** *Stephanoderes* **1929.**—*Bull. Kenya Dept. Agric.*, no. 9, 19 pp., 1 fldg. table. Nairobi, 1930.

The first section of this report, by Trench, deals with the practical application in Kenya of the Diseases of Plants Prevention (Coffee) Rules with regard to the coffee bean borer, *Stephanoderes hampei*,

Ferr. Subsequent to the dicovery of this beetle in Kenya [*R.A.E.*, A, xvii, 625], 67 coffee plantations were inspected, of which 17 were found definitely to be infested. Draft regulations regarding control measures were drawn up, which were chiefly based on stripping the bushes and collecting gleanings, in order to give a certain period when there should be no coffee in a condition favourable to the breeding of the beetle. The movement of coffee from all farms found to be infested was prevented until such coffee had been treated either by immersion in water for 96 hours or by a mechanical dryer. Experiments with samples of green and hulled coffee and mature mbuni (coffee that has been allowed to dry in the field), to determine the effect of such water treatment on the quality of the product, showed that there is a tendency for the beans to be discoloured, those from very immature berries turning black. All the samples acquired an unpleasant aroma, which was weakest, or, in the case of mbuni, absent, when the water was changed daily. The taint decreases noticeably if the beans are exposed to the air after hulling. The treatment may therefore be practised, provided that the water is changed every day, with only a slightly deleterious effect on the commercial value of the product. A table is given showing the distribution of the more common diseases and pests occurring in coffee plantations in Kenya. The Lamiid, *Sophronica ventralis*, Auriv., has been causing more damage than *Stephanoderes*; it particularly infests mbuni coffee. No parasites of either beetle have been found, and introductions from Uganda are suggested [*cf.* xvii, 695].

The second section of the report, by Anderson, deals with the technical side of the campaign. The insects known to bore in coffee berries in Kenya are *Stephanoderes hampei*, *Sophronica ventralis*, and *Thliptoceras octoguttale*, Feld., *Eucosma nereidope*, Meyr., and *Deudoryx lorisona*, Hew., but the damage done by the last two is very small. Lists are given of the districts in which the first three pests occur, showing the percentages of infestation, which varied from 0·7 to 8·2 for *Stephanoderes*, 0·1 to 17·2 for *Sophronica* and 0·6 to 35·0 for *T. octoguttale*. *Sophronica* is much more widely distributed than *Stephanoderes* and is responsible for more loss. No instance has been observed of the latter attacking green, ripening or ripe berries, only mbuni coffee being infested. *Thliptoceras* is found wherever coffee is grown in the Colony, the larva boring into the green berry and feeding on the developing beans. Each larva damages many berries, passing from one to another and often leaving silken threads round the clusters.

SMEE (C.). **Locusts and their Destruction.**—*Bull. Dept. Agric. Nyasaland Prot.*, Ent. Ser. no. 6, 3 pp. Zomba, April 1929.

This is a brief account of methods of controlling locusts in view of the possibility of the occurrence of outbreaks in Nyasaland.

Plant Pests and Diseases (Amendment) Ordinance, 1928. 2 pp. Zomba, Nyasaland, 14th April 1928.

The section of the Ordinance of 1924 [*R.A.E.*, A, xiii, 458] dealing with the plants that may not be introduced into Nyasaland without a special permit is altered to prohibit the introduction of any plant or seed, except seeds of flower-garden plants, ornamental trees and vegetables, without a special permit.

Vinson (J.). **Le thrips de l'oignon**—*Thrips tabaci*, **Lindeman.**—*Leafl. Dépt. Agric. Maurice*, no. 29, 3 pp. Réduit, 1929.

Thrips tabaci, Lind., has caused injury to onions in Mauritius for several years, particularly in 1928. The eggs, which hatch in 3–5 days, are laid under the epidermis of the leaf. At first the larvae feed on the most tender part of the plant, sheltering beneath the leaf sheaths, but eventually they spread all over it. After about 10 days they enter the pupal stage under the leaf sheath or at the base of the plant just below soil level, the adults emerging 4–5 days later. Several generations occur between April and September, when the thrips disappear completely from the fields. Although young plants invariably die soon after being infested and bulb formation is checked and flowering prevented in those that are rather more advanced, mature ones suffer very little. A dry season appears to be favourable to the thrips and unfavourable to the plants. Thus, in 1928, the yield per acre, which is normally 8–10 tons, was reduced to a few hundred pounds, and there was practically no production of seed. The harvest generally takes place in September or October, and those bulbs that have not then attained the required size are kept and planted the following March without being disinfected. It is probable that these bulbs harbour dormant pupae of *T. tabaci* and are the initial cause of infestation. Preventive measures should therefore include the disinfection of these bulbs as well as the destruction of all rubbish remaining on the ground in the infested plantation and any neighbouring vegetation likely to harbour the thrips, which are not capable of migrating far.

Sprays recommended include 4 oz. nicotine sulphate, 4 lb. whale oil soap and 40 gals. water, which has hitherto given the most satisfactory results, and a simple decoction of tobacco leaves at the rate of about 1 lb. to 2 gals. water. The liquid should be carefully applied in the morning when the thrips emerge for a short time from the folds of the leaves. Several applications should be made at intervals of 10 days until within about a month of harvest. The planting date should be advanced as far as possible so that the thrips, which only reproduce in large numbers in winter, will not infest the plants until they are sufficiently mature to resist attack.

Wall (R. E.). **A Comparative Study of a Chalcid Egg Parasite in three Species of Plataspidinae.**—*Lingnan Sci. J.*, vi, no. 3, pp. 231–239. Canton, 1930.

The following is largely taken from the author's summary: An unidentified Chalcid egg parasite of *Coptosoma cribrarium*, F., was discovered in Canton in June 1927, and in the insectary was found to parasitise readily the eggs of *Brachyplatys subaeneus*, Westw., and another species of *Coptosoma*. All three Pentatomids commonly feed on cultivated beans; their eggs vary greatly in size, and the individual parasites emerging from them vary in direct proportion. Seventy-six per cent. of the egg-groups or 51 per cent. of all the eggs of *C. cribrarium* collected in the field during July and August were infested. The host egg may be successfully parasitised at any time during about the first two-thirds of its development. Parthenogenesis appears to have occurred in the case of one parasite, and mating has not been

observed, oviposition taking place within 24 hours after emergence. The adults live about two days and deposit from 10 to 20 eggs, one in each host egg. The life-cycle at summer temperatures lasts 13–14 days, as compared with 7–9 weeks in the case of the hosts. The latter have probably about 4 overlapping generations a year, and the parasite 16. It is thought that sufficient host eggs can be found during the winter to enable the parasites to continue their development, which is very much retarded at that season.

VAN DER MEER MOHR (J. C.). **Overzicht van de proeven ter bestrijding van de rupsenplaag in de tabak genomen in de jaren 1928 en 1929.** [A Survey of Experiments in 1928 and 1929 against Caterpillar Pests of Tobacco.]—*Meded. Deli Proefst.*, (2) lxiv, 20 pp. Medan, January 1930. (With a Summary in English.)

Lepidopterous pests of tobacco in Deli, Sumatra, are usually combated by spraying with lead arsenate during the first three weeks after the seedlings have been planted in the field, and afterwards by dusting with a mixture of lead arsenate and finely sifted soil. In 1928 preliminary trials, the substitution of dusts for the sprays appeared to give inferior results. Subsequently, however, detailed experiments showed dusting to be at least as effective as spraying. The dust can be applied much more quickly, and though a larger quantity of insecticide is required, the leaves are not more injured than by the spray. The insecticides used were proprietary brands of lead and calcium arsenate, and experiments comparing them are discussed at some length, but there was little difference in their effectiveness.

The results of dusting experiments in tobacco drying sheds in 1928 are tabulated, together with those of similar experiments made previously. It is concluded that dusting tobacco in the sheds reduces the amount of injured leaf, but it remains to be seen whether the method can be adopted without difficulty in practice. In one case the injured leaf was 3·7 per cent. less when dusting had been carried out, a dust containing 10 per cent. lead arsenate being used.

WOODHILL (A. R.). **The Citrus Red Scale** (*Chrysomphalus aurantii*). **Progress Report on Fumigation and Spraying Experiments.**—*Agric. Gaz. N.S.W.*, xli, pt. 2, pp. 125–130, 3 refs. Sydney, 1st February 1930.

In continuation of experiments on the fumigation of *Citrus* against *Chrysomphalus aurantii*, Mask., in New South Wales [*R.A.E.*, A, xii, 570 ; xiv, 332 ; xv, 213], investigations were undertaken from 1927 to 1929 to determine which method and dosage could be relied on to give the most complete kill over a number of years without economic injury to the trees. At least two, and sometimes four, identical experiments were carried out each season, mainly on oranges, though lemons were sometimes used. In most cases the trees were fumigated for 45 minutes, calcium cyanide dust being applied during the day, and potassium cyanide by the pot method during the late afternoon or at night. It was found that inspection shortly after

treatment might show an apparently complete mortality and yet the Coccid might be plentiful during the following season. It was therefore decided to allow 12 months to elapse before comparing the treated and untreated trees. Field observations have shown that the spread of the scale from tree to tree is very slow, and that scales occurring the following season on treated trees are the progeny of those surviving fumigation rather than migrants from untreated trees.

The fine form of calcium cyanide at the rate of 1 oz. to 175 cu. ft. proved definitely unsatisfactory, and even when the dosage was increased to 1 oz. to 100 cu. ft. a low mortality was sometimes obtained. The coarser form also gave unsatisfactory results at 1 oz. to 100 cu. ft., and a considerable increase in dosage is necessary with both these materials. The pot method, using 1 oz. potassium cyanide to 125 cu. ft., gave satisfactory but not perfect results, and a slight increase in dosage is suggested. Experiments are being carried out to determine the amount of increase necessary with these materials and the effect on the trees. None of the dosages used has consistently produced a sufficiently high mortality to keep the majority of the trees free from infestation for two years. No serious injury to the trees resulted from the pot method with a dosage of 1 oz. to 125 cu. ft. provided that fumigation was not carried out in bright sunlight, nor with any of the dosages of calcium cyanide employed, in spite of a considerable amount of variation in temperature and humidity ; the slight damage that was observed indicated that injury is more likely to occur when both temperature and humidity are high, particularly when the fine type of dust, which rises readily, is used. The coarser form is safer under all conditions. Lemons are very susceptible to injury from a deposit of calcium cyanide dust, and the coarser type should always be used for this fruit except under very dry conditions.

Experiments were also undertaken with sprays of resin and soda, and miscible red and white oils. The resin-soda spray cannot be relied on to give as good results as oil sprays. White oils were slightly more effective than red, the results being comparable to those obtained with fine calcium cyanide at the rate of 1 oz. to 100 cu. ft., but the highest mortality was not equivalent to that obtained with the pot method, using 1 oz. to 125 cu. ft. Scorching of fruit and foliage sometimes occurred with red oils even when perfectly emulsified and applied under cool conditions, but white oils caused no apparent injury in spite of adverse conditions, and they also emulsified readily even in hard water. Heavy miscible white oils have been reported to cause a reduction in blossoming and a retardation in the colouring of the fruit, and experiments are now in progress to determine whether this type of injury will occur under conditions in New South Wales.

RAFF (J. W.). **Observations on the Life History of Saw-flies.**—*Vict. Nat.*, xlvi, no. 11, pp. 215–217, 1 ref. Melbourne, March 1930.

In breeding experiments with the larvae of *Perga dorsalis*, Leach, and two other species of *Perga*, which are serious pests of *Eucalyptus* in Victoria, it was found that they burrowed 3–4 inches into the soil to pupate. The adult sawflies did not emerge for at least 5 months, and there was a great preponderance of females. In some cases Tachinid parasites were obtained.

Burns (A. N.). **Report for the Month ended 12th November 1929.**—*Queensland Agric. J.*, xxxii, pt. 6, pp. 579–581. Brisbane, 1st December 1929.

False wireworms, probably the larvae of *Dasus* (*Gonocephalum*) *carpentariae*, Blackb., have recently occurred in large numbers in fields of young cane, entering the eyes of the sets and devouring the whole interior. The sets should be dipped in a mixture of 1 lb. sodium arsenate, 8 lb. molasses and 8–10 gals. water and planted while they are wet, so that the soil adhering to them will become impregnated with the poison, which will also penetrate the cut ends of the set to a depth of about ¼ in. The larvae and pupae are briefly described. The larval stage lasts about 6–8 weeks in the spring and the pupal stage 10–12 days, the pupa being enclosed in a small oval cell in the soil. The beetles congregate under rubbish, and heaps of freshly pulled weeds have been recommended as traps, from which the adults should be collected at night.

Although the Lygaeid, *Phaenacantha australica*, Kirk. (linear bug), is sometimes very abundant in canefields, control measures have not as yet been necessary. There appear to be three generations as a rule, with possibly a partial fourth, nymphs having been observed in November, January and February, and May and June. In the laboratory it was found that the adults hibernate under rubbish, etc.; eggs are laid about October and hatch at the end of the month or in early November. The eggs have been recorded as being dropped loosely on the surface of the ground, but in the laboratory the females laid them singly and attached them to various objects. Hatching occurred in about 12 days.

Willard (H. F.) & Bissell (T. L.). **Parasitism of the Mediterranean Fruit Fly in Hawaii 1922-1924.**—*Circ. U.S. Dept. Agric.*, no. 109, 12 pp., 10 refs. Washington, D.C., March 1930.

The degree of parasitism of *Ceratitis capitata*, Wied., in Hawaii during 1922–24 is recorded, following previous reports [*R.A.E.*, A, xiv, 527]. The average infestation of fruit during this period was less than at any time since 1916, indicating a decrease in the abundance of adult flies. Parasitism by *Opius humilis*, Silv., reached its minimum (4·1 per cent.) in 1923, probably owing to the activities of *Diachasma tryoni*, Cam., and *D. fullawayi*, Silv., which always eliminate *O. humilis* when occurring in the same host larva, but in 1924 the degree of parasitism rose to 14·5 per cent., which is greater than for any year since 1916. During the cooler months, both species of *Diachasma* hibernate, this period being accompanied by increasing effectiveness of *O. humilis*. The average parasitism by the four species remains as in previous years at about 50 per cent. of the larvae in the neighbourhood of Honolulu.

Pope (W. T.). **Mango Culture in Hawaii.**—*Bull. Hawaii Agric. Expt. Sta.*, no. 58, 27 pp., 18 pls., 16 refs. Washington, D.C., October 1929.

The most serious insect pests of the mango tree in Hawaii are *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) and *Cryptorrhynchus*

mangiferae, F. (mango weevil). The former became established about 1907 and attacks many kinds of fruit. On mango, the eggs hatch in 2–6 days, and the larvae feed on the maturing fruit, causing it to fall in a decaying condition. They enter the soil for pupation, which lasts about 10 days in warm weather or as long as 50 in cold. The varieties of mango are discussed with reference to their resistance to the fly. *Cryptorrhynchus mangiferae* was first observed in Hawaii about 1905. The adults generally appear about 15th May, and the female oviposits in slight incisions on the surface of the fruit before it is half grown, the larvae burrowing into the kernel. One to four larvae may occur in one fruit, but their presence is not evident, though the fruit eventually decays from the seed outwards, and frequently drops to the ground. In late June or early July they become mature and pupate within the seed. The life-cycle is thought to occupy about 40 days, the rest of the year being spent in hibernation, in the ground or among stones, old leaves or other litter. Adults remained alive when kept without food or fresh air in a small cork-stoppered bottle for 140 days. Litter and fallen fruit should be collected and burnt as they harbour numbers of adult weevils. It is suggested that parasitic enemies should be found and introduced into Hawaii.

VENABLES (E. P.). **Observations on the Woolly Aphis of the Apple** *Eriosoma lanigerum* (**Hausm.**).—*Proc. Ent. Soc. Br. Columbia*, 1929, no. 26, pp. 28–33. Vancouver, B.C., 1929. [Recd. 1930.]

An account is given of observations on *Eriosoma lanigerum*, Hausm., carried out in 1928 in the Okanagan valley, British Columbia, owing to the prevalence of the Aphid throughout the orchard sections and the probability that it is the main cause of the spread of perennial canker of apple, *Gloeosporium perennans* [*R.A.E.*, A, xvii, 666]. In British Columbia the elm plays no part in the life-cycle of *E. lanigerum*, apple being the food-plant in summer and winter. The author was unable to trace migration to any other plant, although a fair number of elms occurred near some orchards. The winged form was present only in the autumn, the females appearing in late August and being extremely numerous by early September. Although these late individuals contained embryonic young, both males and females, these were never produced, and no sexual forms were found on apple trees. The literature on the subject is briefly reviewed [xvii, 118, etc.]. The only way in which the author was able to secure normal sexual forms from the winged migrants was by enclosing the latter in a tightly corked vial, when they soon died and a few young were found on the glass. When caged over apple twigs or elm the winged migrants did not reproduce.

The injury caused to branches and twigs of apple, which takes the form of nodular swellings or galls at the point of feeding, is discussed ; the wood is blackened and dead, and the pith itself is frequently severely injured. A series of comparative measurements of the feeding setae of *E. lanigerum* and *Aphis pomi*, DeG. (*mali*, F.) which does not cause such peculiar gall-formation on apple twigs, showed that those of *E. lanigerum* are approximately one-third longer. This enables it to penetrate through the cambium and reach the xylem or wood beyond. Microscopical preparations of wood sections demonstrated the path followed by the setae and that the cambium is the point at

which feeding takes place. The galls produced by *E. lanigerum* on the roots of apple are of a different character, being more globular in outline and often occurring in clusters.

Syrphids, which become very numerous during August and September, when the Aphid reaches its maximum in the interior of British Columbia, appear to be of some importance in its control; the species reared by the author were *Syrphus venablesi*, Curran, *S. opinator*, O.S., and *S. meadi*, Jones. Coccinellids and the larvae of lace-wing flies feed on scattered migrating individuals of *E. lanigerum* that are not protected by a woolly covering. The introduction of *Aphelinus mali*, Hald., which is quite common in eastern Canada, is suggested.

E. americanum, Riley, and *E. ulmi*, L., were also found in the Okanagan valley, both occurring on elm in winter, whereas in the summer the former fed on the roots of currant and gooseberry, and the latter on those of June berry (*Amelanchier* spp.).

GLENDENNING (R.). **Host Adaptation in the European Satin Moth.**—*Proc. Ent. Soc. Br. Columbia*, 1929, no. 26, pp. 34–38. Vancouver, B.C., 1929. [Recd. 1930.]

In 1920, the year after it was first recorded in British Columbia [*R.A.E.*, A, xiii, 191], *Stilpnotia salicis*, L., was only found on introduced poplars, but next year a few larvae were observed on native cottonwood (*Populus trichocarpa*) and considerable damage was caused to this tree in 1922. Experiments were therefore carried out in the autumn of that year to find whether a gradual adaptation to the native cottonwood was developing. Larvae from moths that had been reared on cottonwood and others of a strain from lombardy poplar (*P. nigra italica*) were placed under identical conditions on cottonwood foliage in trays. The mortality was much higher among the latter strain, only 4 per cent. surviving in each of two experiments at the time of hibernation, as compared to 44 and 24 per cent. of the former strain. These experiments indicated that an adaptation to new food habits was taking place. In 1929, thousands of acres of *P. trichocarpa* were defoliated to the extent of 80–100 per cent., proving that the moth has completely adapted itself to this tree. The moth now ranges all over the lower Fraser valley and is spreading eastward. A similar adaptation has occurred in the case of *Populus vancouverensis* and native species of willow.

As the females of *S. salicis* lay their egg masses anywhere, even on iron fences and concrete walls, the author does not consider that the host selection by the ovipositing moths would be an important factor as it is some other insects [*cf.* x, 83, etc.]. It was noticed, however, that a severe infestation of cottonwood in one locality would not necessarily be accompanied by a similar infestation of adjacent lombardy poplar or willow, or again that an outbreak on willow might occur without an infestation of neighbouring cottonwoods or poplars.

DOWNES (W.). **The Cherry Fruit Worm** (*Grapholitha packardi* **Zell.**).—*Proc. Ent. Soc. Br. Columbia*, 1929, no. 26, pp. 39–43, 4 figs. Vancouver, B.C., 1929. [Recd. 1930.]

Much damage to sour cherries has recently been caused on Vancouver Island by the larvae of *Cydia* (*Grapholitha*) *packardi*, Zell., losses to

growers being in some instances as high as 36 per cent. of the crop, while individual trees may have an infestation as high as 90 per cent. The eggs, larvae and adults are briefly described. There is only one generation a year, and development is greatly affected by temperature. In 1927 the moths emerged about 25th May, and oviposition occurred about mid-June, whereas in 1929 it took place ten days later. The eggs are usually laid singly on the fruit and hatch in 10–11 days. The young larvae bore into it and mine around the stone ; they reach maturity in about 30 days, when they emerge in search of hibernating quarters. If the season is cold and backward, the development of the larvae is delayed and most of them will be still in the cherries at picking time. Hibernation takes place in dry twigs or pieces of bark, in which the larvae burrow, the dead stubs of pruned branches being preferred ; the entrance to the burrow is closed with a plug of silk. Pupation occurs within the twigs during the second week in May ; in 1929 the pupal stage averaged 42 days.

In experimental work on the control of the pest good results were obtained by the use of a summer oil emulsion combined with nicotine sulphate, applied when moth emergence was at its height. This spray appears to have a repellent as well as an ovicidal effect ; the formula is 1 pint Volck oil, 3 oz. nicotine sulphate, 3 oz. calcium caseinate and 12 gals water. On the treated trees the infestation was 2·36 per cent., as compared with 19·08 per cent. on the unsprayed ones, and 8·06 per cent. on those to which a spray of ¾ pint nicotine sulphate to 40 gals. water and 5 lb. fish-oil soap was applied. Other measures recommended are clean culture in the orchards, to diminish the hibernation quarters of the larvae, and the destruction of all wild cherries growing near.

ANDERSON (W. B.). **Injury to Primulas from Vine Weevil.**—*Proc. Ent. Soc. Br. Columbia*, 1929, no. 26, pp. 46–48. Vancouver, B.C., 1929. [Recd. 1930.]

It has been found that extensive injury caused to primulas, and usually attributed to rotting of the roots during the wet weather, is caused by *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., which has long been known in British Columbia as a pest of strawberries. The eggs hatch in late summer or autumn, and the larvae feed on the root, completing their work after hibernation so that during the blooming season plants loaded with flowers suddenly droop and die. Varieties of primulas with hard, wiry roots seem to be immune from infestation, whereas those with fleshy roots suffer very severely. Most of the damaged plants may be saved by replanting the thick cormous crown (which remains uninjured) and keeping it well watered in dry weather. As a matter of precaution, care should be taken to free the soil of any larvae, for which purpose all the primula plants should be dug up in September and the roots washed of all soil. The bed should be carefully dug over, finally turning it over with the hands to a depth of at least six inches and destroying all larvae that may be discovered. Crude flake naphthalene, at the rate of about 1 lb. to 20 sq. ft., should then be well mixed with the soil, and the primulas replanted.

Strawberries growing in a bed treated with naphthalene were quite free from infestation, while an adjoining patch of Alpine primulas were badly damaged, but the latter recovered in a month after the treatment described had been applied.

Spencer (G. J.). **Another Household Pest arrives in Vancouver. The Fire Brat** *Thermobia domestica* **Packard.**—*Proc. Ent. Soc. Br. Columbia*, 1929, no. 26, pp. 58–60, 1 fig. Vancouver, B.C., 1929. [Recd. 1930.]

A colony of *Thermobia domestica*, Pack., not previously recorded in Vancouver, was found in September 1928 in a laundry in the basement of a hospital. The gradual spread westward of this insect across Canada is briefly described, and short notes on its bionomics are given. It is most active at 90–105° F., and both heat and moisture are essential to it. It shrivels up and dies in a dry hot atmosphere, and as it does not feed on liquids, it apparently absorbs moisture through the cuticle. All kinds of farinaceous foods, starch and certain glues, and especially dried meats, are preferred for food ; fat and moist food are avoided. *Thermobia* can easily be exterminated by sprinkling sodium fluoride round the places it frequents.

Jenkins (A. E.). **Insects as possible Carriers of the Citrus-scab Fungus.**—*Phytopathology*, xx, no. 4, pp. 345–351, 2 figs., 12 refs. Lancaster, Pa., April 1930.

An Endomychid larva was observed on a leaf of sour orange in Florida, feeding on the fungus, *Sphaceloma fawcetti*, which causes scab of *Citrus*. The stomach contents of the larva were found to be conidia and conidiophores of the fungus, apparently unchanged. Other Arthropods, or their remains, including Coccids, gall mites, flies and ants, were also seen on the leaves and may be concerned in the dissemination of the fungus. Fungus growths showing signs of the feeding of insects were observed on the leaves, as well as insect excreta containing conidia and hyphae from which the fungus was obtained in pure culture. Some insect, therefore, feeding on the fungus, is evidently capable of acting as a vector by passing it in a viable condition through the intestinal tract.

Eddy (C. O.) & Clarke (W. H.). **Control of the Mexican Bean Beetle for 1930.**—*Circ. S. Carolina Agric. Expt. Sta.*, no. 39, 16 pp., 4 figs. Clemson College, S.C., March 1930.

The early part of the season of 1929 was favourable to the increase and spread of *Epilachna corrupta*, Muls., in South Carolina, and the infestation was the most general and widespread that has occurred since the beetle was first observed in 1921. In mid-season, however, continuous rains accompanied by low temperatures reduced its numbers, and although it again increased during the last part of the season, the injury caused was not great and no further noticeable spread occurred.

Hibernation studies [*R.A.E.*, A, xviii, 17] indicate that a normal emergence of slightly less than 15 per cent. of the hibernating beetles may be expected at Clemson College when average climatic conditions prevail. Adults were found feeding in the field as early as 19th April ; 25 per cent. had emerged by 21st April, 50 per cent. by 29th April, 75 per cent. by 7th May and 100 per cent. by 7th June. Overwintering beetles were recorded from beneath the loosened bark of a fallen pine at the edge of a wood and on the ground under the leaf of a mullein plant (*Verbascum thapsus*) in an uncultivated field. This field had

not been under cultivation in the previous year, and no cultivated field was nearer than $\frac{3}{4}$ mile. The seasonal occurrence and the periods of development of the beetle are shown in a table. Most of the adults of the second and third generations went into hibernation. Eggs of a fourth generation were produced, but did not mature under normal field conditions.

Various insecticides used for the control of *E. corrupta* are discussed [*cf.* *R.A.E.*, A, xv, 401]. Under the weather conditions prevailing in 1929, magnesium arsenate was the only arsenical that gave satisfactory results without injuring the plant. Calcium arsenate, which had been successfully used during dry seasons, scorched the plants severely. This is attributed to the number of brands now on the market and to the wetter summers of recent years; as a consequence, this material is not considered a reliable insecticide for use on beans. Pyrethrum soap sprays, which had given satisfactory control when the infestations were small, did not give as good results as magnesium arsenate in severe infestations, even when applied bi-weekly. No spraying programme was as satisfactory as it had been in the past, and it was found necessary to reduce the interval between applications from 7–10 days to 3–7. Spraying is more effective than dusting, and magnesium arsenate at the rate of 1 lb. to 50 U.S. gals. water is recommended. Where a spray cannot be used, a dust of 1 lb. magnesium arsenate to 3 lb. hydrated lime may be substituted. Insecticides should always be applied to the lower surface of the leaves, spraying being carried out when the plants are dry and dusting in the morning when the dew is still on them.

With regard to cultural measures [*cf.* xv, 402; xvii, 619], plants should be ploughed under to a depth of 5 inches with wide-bottom ploughs. Disking before ploughing is recommended, especially on hard soils or where there is much vegetative growth. Rubbish likely to afford hibernating quarters for the beetles should be cleared away, and beans should be planted in rows rather than in clumps in order to facilitate the application of an insecticide.

Eddy (C. O.), Brunson (M. H.) & Clarke (W. H.). **The Oriental Fruit Moth.**—*Circ. S. Carolina Agric. Expt. Sta.*, no. 38, 31 pp., 15 figs., 18 refs. Clemson College, S.C., February 1930.

Although it has been present in the State for some years, *Cydia* (*Laspeyresia*) *molesta*, Busck, first became an important pest of peaches in South Carolina in 1929. During that season, injury in two orchards to early varieties amounted to 18·1 and 25 per cent. respectively. In August and September the fruit of 13 late varieties showed an infestation of 32 per cent. Further investigations revealed that 12 per cent. of the entire crop in the State was rendered unmarketable. The nature of the injury to the twigs and the fruit is described, and characters are given for distinguishing the larvae from those of *Anarsia lineatella*, Zell. (peach twig borer), the habits of both pests being very similar. It seems probable from observations in other States [*R.A.E.*, A, xv, 261; xvi, 120; xviii, 172, etc.] that *C. molesta* has about five generations a year in South Carolina. The only parasite that appeared effective during 1929 was the Chalcid, *Trichogramma minutum*, Riley, which infested over 50 per cent. of the eggs. Control measures employed in other States against this moth are discussed.

Back (E. A.) & Cotton (R. T.). **Control of Insect Pests in stored Grain.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1483, 30 pp., 34 figs. Washington, D.C., December 1929.

This is a revision of a bulletin previously noticed [*R.A.E.*, A, xiv, 470]. Mixtures of a small percentage of carbon bisulphide in carbon tetrachloride, to which may be added a small quantity of sulphur dioxide or other chemical, are now being used rather extensively for grain fumigation; these should not be manufactured at home. Ethylene oxide also shows promise of being an excellent fumigant for stored grain when used in the proportion of 1 part by weight to 7 parts of carbon dioxide; such a mixture greatly increases the insecticidal properties and obviates any possibility of fire. For 1,000 cu. ft. of space, 2 lb. of ethylene oxide with carbon dioxide in proportion gives satisfactory results; the methods of applying the mixture to the grain are, however, still in the experimental stage. The successful use of hydrocyanic acid gas as a fumigant for grain in bulk is not possible for the average farmer at the present time; the method of application is very involved, and its use is restricted to elevators with modern machinery and technical workers. Briefly, the treatment consists in thoroughly mixing fine granular calcium cyanide with wheat throughout the bin, by means of a motor-driven hopper installed over the stream of wheat at a point close to where the wheat enters the bin. In this manner, 25 lb. of the fumigant is incorporated in each 1,000 bushels of wheat; this fumigation can be conducted with a temperature as low as 40° F. and should be continued for 72 hours.

Larson (A. O.) & Fisher (C. K.). **Insects screened from Bean Samples (Hemip., Coleop., Orth., Hym., Dip.).**—*Ent. News*, xli, no. 3, pp. 74–76. Philadelphia, Pa., March 1930.

A list is given of the 39 species of insects belonging to 37 genera collected from samples of beans in California. About 1 lb. of insects was removed from samples weighing about 6,000 lb., and as the bean crop of the United States for the years 1924 to 1928 inclusive has averaged more than 1,023,000,000 lb., more than 85 short tons of insects must be carried into the warehouses each autumn.

Reinhard (H. J.). **The Cotton-square Borer.**—*Bull. Texas Agric. Expt. Sta.*, no. 401, 36 pp., 4 figs., 22 refs. College Station, Tex., September 1929.

The Lycaenid, *Strymon melinus*, Hb., all stages of which are described, attacks a great variety of food-plants and is widely distributed in the United States, also occurring in Mexico and Central America. A detailed account is given of its bionomics in Texas, where it is common on cotton, feeding chiefly on the squares. It sometimes causes considerable injury over limited areas, especially during the early part of the growing season. In June and July, it is greatly reduced in numbers by natural enemies; only a small percentage of the second generation escapes parasitism. In the laboratory the Braconid, *Apanteles theclae*, Riley, and the Tachinids, *Exorista* (*Zenillia*) *confinis*, Fall., and *Frontina* sp., were reared from the larvae, and a Chalcid, *Octosmicra* sp. from the pupae. In Texas the butterfly does not pass through a

protracted hibernation period. It is dormant or semi-dormant throughout December and January, this time being apparently passed in the pupal as well as the adult stage. Three generations may occur during the year. Adults of the overwintered generation first appear during February or March. Oviposition begins soon after emergence and continues throughout the warm weather. The eggs are usually. laid singly, on the foliage, but also often on the blooms, fruits or seed-pods of the food-plants. During the summer months the average lengths of the stages were, egg 5·5, larva 23 and pupa 9·5 days.

If the pest is not sufficiently held in check by its natural enemies, dusting with calcium arsenate at the rate of 5–7 lb. to the acre will give satisfactory control. The dust should be applied when the larvae are small, as the later instars feed largely within the squares.

Chapman (P. J.) & Gould (G. E.). **Sweet Potato Sawfly.**—*Bull. Virginia Truck Expt. Sta.*, no. 68, pp. 769–786, 4 figs., 17 refs. Norfolk, Va., 1st July 1929.

During the last few years the sawfly, *Sterictiphora cellularis*, Say. (of which *Schizocerus ebenus*, Nort., and *S. privatus*, Nort., are stated in a note by S. A. Rohwer to be synonyms) has done serious damage to sweet potato in certain fields in Virginia. A map shows its distribution to be chiefly in the southern States, but it also occurs as far north as Wisconsin and New York. The authors have not observed larvae feeding on any other plant than sweet potato (*Ipomoea batatas*) ; morning glory, even when growing in sweet potato fields, was not found infested in Virginia, and in a single test newly hatched larvae died when confined to that plant. The sawfly has, however, been bred from *Ipomoea* sp. in Wisconsin, and its distribution extends beyond the range of sweet potato production. The adult, egg and cocoon are described, and a technical description of the full-grown larva by W. Middleton is included.

There are probably three generations in a year in eastern Virginia, larvae of the first appearing about 1st July. The eggs, which are found in blister-like swellings in the leaves, hatch in 6–7 days in July. The larvae feed for about 10 days, often devouring the whole of the leaf except the basal part of the main veins. After defoliation, 3 or 4 weeks generally elapse before a new generation appears, and vigorous new leaves may be put forth. When full-grown, the larvae construct brownish cocoons at or just below the surface of the soil and remain in them for some days before pupating. The cocoon stage lasts from 9 to 12 days. The method of overwintering is not known, but is probably as a larva in the pupal cell in old sweet potato fields. Serious infestations have been observed in fields where sweet potatoes have been grown in consecutive seasons. The adults are weak fliers, are short-lived and readily succumb to unfavourable weather ; this perhaps accounts for the very localised nature of the infestations.

A parasite, *Schizocerophaga leibyi*, Towns., was an important factor in suppressing the infestation in Virginia in 1928–29 ; it was reared from as many as 60 to 70 per cent. of the cocoons of the sawfly, the adults emerging at about the same time as the adult sawflies. It had previously been obtained from this sawfly in North Carolina and Louisiana. Arsenical sprays or dusts are successful if used while the eggs are hatching. Those recommended are 1½ lb. lead arsenate,

or 1 lb. calcium arsenate mixed with 2 lb. hydrated lime, in 50 U.S. gals. of water, or 1 part calcium arsenate to 7–9 parts hydrated lime as a dust. Crop rotation is important, and sweet potatoes should be planted in the year following an attack at some distance from the old field.

ALDRICH (J. M.). **Notes on Synonymy of Diptera, no. 4.**—*Proc. Ent. Soc. Wash.*, xxxii, no. 2, pp. 25–28. Washington, D.C., 1930.

The Tachinids, *Daeochaeta harveyi*, Towns., and *Masicera tenthredinidarum*, Towns., recorded as common parasites of sawflies in the United States, are both identical with the European sawfly parasite *Ptychomyia selecta*, Mg.

CARTER (W.). **Some Phases of the Sugar-beet Leafhopper Problem. (Abstract.)**—*J. Wash. Acad. Sci.*, xx, no. 8, pp. 153–155. Baltimore, Md., 19th April 1930.

In Idaho, *Eutettix tenella*, Baker, is confined to short-lived annual plants, growing to a height of about 3 feet, or to low-growing perennial shrubs. It is therefore possible to measure the temperature and humidity of its environment and, by sweeping, to obtain data as to the insect population. From this information and from records of the growth and development of the food-plants, valuable comparative data between seasons can be obtained. A rather definite correlation appears to exist between certain winter types and outbreaks of the leafhopper in the following season, and formal predictions have been issued for the last three beet seasons, with the result that losses have been materially reduced in a year of injury and acreage increased in a favourable year. Soil surface temperatures are being used in an attempt to predict time of migration. If this were known, it would be possible to make some variation in the planting time, and a repellent spray applied to the beet just before migration should be of great value.

GAHM (O. E.). **Note on *Linopodes antennaepes* Banks. (Abstract.)**—*J. Wash. Acad. Sci.*, xx, no. 8, pp. 155–156. Baltimore, Md., 19th April 1930.

The mite, *Linopodes antennaepes*, Banks, is recorded as causing serious damage to mushrooms in certain districts in Ohio (where the yield was reduced by about 40 per cent.), Illinois and Minnesota. The mite may destroy the whole of the " root system," and if it becomes generally distributed, will rank as one of the most injurious pests of mushrooms.

CLAYTON (E. E.). **A Study of the Mosaic Disease of Crucifers.**—*J. Agric. Res.*, xl, no. 3, pp. 263–270, 2 figs., 5 refs. Washington, D.C., 1st February 1930.

Inoculation experiments carried out in Long Island in 1926 to determine the reaction of the more important crucifers, cabbage, cauliflower and Brussels sprouts, to mosaic disease, the susceptibility

to which of turnips, swedes, mustard and Chinese cabbage (*Brassica chinensis*) is well-established, showed *Brevicoryne brassicae*, L. (cabbage Aphid) to be exceptionally effective as a vector. In two experiments, *Myzus persicae*, Sulz. (green peach Aphid) gave unsatisfactory results. Inoculation by rubbing crushed tissues from diseased plants into the leaves of healthy ones so as to injure the midrib was highly successful with the more susceptible plants, but not with those possessing a degree of resistance. The incubation period varied from 3 to more than 5 weeks. Diseased swedes were the usual source of inoculum, being easily infected, and if kept in a cool place continuing to make fair leaf growth. *B. brassicae* also multiplies freely on this food-plant. Since Brussels sprouts and cabbage are both hardy enough to live over the winter unprotected in Long Island, they may be the reservoir of disease from one season to the next. Roots from diseased swedes kept over the winter threw up seed stalks that showed mosaic symptoms, but nevertheless matured seed that producd a healthy crop.

White and black mustard (*Brassica alba* and *B. nigra*), Chinese cabbage, turnips, swedes, and rape were found to be susceptible to the disease. Brussels sprouts and cauliflower, although susceptible, were not easily infected. Cabbage was either highly resistant or immune, with some evidence that it may serve as a reservoir. Symptoms varied widely with the different food-plants and also with environmental conditions.

Sweetman (H. L.). **Field Studies of the Physical Ecology of the Alfalfa Weevil.**—*Bull. Wyoming Agric. Expt. Sta.*, no. 167, 32 pp., 6 graphs, 7 refs. Laramie, Wyo., September 1929.

An account is given of the results secured in studies carried out in Wyoming to determine the influence of ecological factors in the distribution of *Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gyll.), which has been introduced comparatively recently, with a view to drawing up more rational quarantine regulations. The overwintering adults deposit their eggs in spring and early summer in holes made in the stems of plants, a high percentage of the eggs being placed in the hollow, green stems of lucerne within a few inches of the crown. The larvae hatch in 1–4 weeks according to temperature and feed on the leaves and growing tips of lucerne and clover for 3–6 weeks, spinning cocoons among dead leaves on the plants or rubbish on the ground when mature. The pupal stage lasts 3–10 days, and only one generation is produced annually.

The following is taken from the author's summary and conclusions: The temperatures of the stems, leaf surfaces and growing tips of lucerne were very close to those of the air surrounding them between 7° C. [44·6° F.] and 42° C. [107·6° F.]. The soil surface in lucerne fields, when exposed to the sun, often reached temperatures between 50 and 60° C. [120–140° F.] unless the soil was quite moist. Rubbish composed of dead lucerne stems and leaves, when exposed to the sun, often reached temperatures exceeding 50° C. ¼ in. below the surface. The mean daily temperatures of the air for the ten hour periods [6.45 a.m. to 4.45 p.m.] at the 3½ ft. level averaged from 2 to 2·6° C. [about 4° F.] above those secured among plants during May, June and July and the mean daily temperatures of the 24–hour days were very similar at the different levels. This emphasises the value of temperature

records taken near the $3\frac{1}{2}$ ft. level. The removal of a crop of hay produces temperature changes near the ground that may be extremely disastrous to the immature stages of the weevil.

The relative humidity during the day was much greater among the plants than at $3\frac{1}{2}$ ft. above the ground, and at night often reached 100 per cent. This shows a wide variation from the records of the United States Weather Bureau, which are usually taken at $3\frac{1}{2}$ ft. Precipitation records give very inaccurate information regarding moisture conditions in lucerne fields during the season when irrigation water is being applied. Air currents below the tops of the plants are greatly reduced when compared with those above the plants. Wind velocities above the plants must exceed 25 miles an hour to cause any considerable disturbance to the insects on them.

The adult weevils became active when the temperature reached 10–12° C. [50–53·6° F.]. Very few adults were found on the soil surface when the surface temperature increased to 35° C. [95° F.] or higher. No response of the adults to moisture, light or air currents was observed, nor has any evidence of flight by *H. variabilis* been obtained in the field. The examination of stems in the field showed that 93 per cent. of the egg clusters were placed in green stems, 6 per cent. in dead standing stems and 1 per cent. in dead, fallen stems. Of the clusters 30 per cent. contained 6–9 eggs and 63 per cent. contained 3–12. Most of the eggs are deposited in the stems near the crown, 91 per cent. being situated within 6 inches and 79 per cent. within 3 inches of it, and 85 per cent. in the hollow stems. The larvae, which concentrate near the tops of the plants as long as food is available, secluded themselves in the growing tips and axils of the plants when the lucerne was disturbed by wind and rain.

BECKWITH (C. S.) & HUTTON (S. B.). **Cranberry False Blossom and the Blunt-nosed Leafhopper.**—*Bull. New Jersey Agric. Expt. Sta.*, no. 491, 16 pp., 5 figs., 4 refs. New Brunswick, N.J., December 1929.

False blossom of cranberries, which was first noticed in New Jersey in 1915, has spread rapidly during the last five years and threatens to ruin all the cranberry bogs of the State. It is widespread also in Massachusetts and Wisconsin. Field tests are described which practically prove that *Euscelis striatulus*, Fall. (blunt-nosed leafhopper) is the vector of the disease [*cf.* *R.A.E.*, A, xviii, 111]. Other leaf-hoppers occur on cranberries but have apparently no connection with false blossom [*cf.* xvii, 30, 672 ; xviii, 277]. A study of the life-history of *E. striatulus* has been made during the past two years. Although it has been reported on other plants, cultivated cranberry seems to be the only food in New Jersey except, to a certain extent, wild cranberries, on which it is probably controlled by natural conditions. There is only one generation a year. Adults are most abundant during July, though nymphs and adults may be found from late May until the end of October. The small egg is thrust lengthwise under the bark of the young, tender stems of cranberry and the wound heals quickly, so that the egg is very difficult to detect. Oviposition occurs in August and September, the eggs hatching in the following May or June. Usually, all eggs have hatched by 20th June, but maintaining the winter flooding until 5th July killed all of them. The nymphs reach

maturity by about 15th July. Although the loss of sap caused by the feeding of the insects undoubtedly reduces the vitality of the plant and the size of the crop, the direct injury is negligible in comparison with that caused by the disease. The method of carrying false blossom has not been determined.

Re-flooding is an efficient method of control on bogs that have sufficient water supply to submerge the vines at the proper time ; if the flood is maintained at its highest point for 12 hours after all the eggs have hatched, all the leafhoppers will be killed or floated off. To destroy those that float, the débris that drifts to the banks should be sprayed with kerosene until covered with a complete film ; generally from 2 to 3 gallons to each acre of the bog is sufficient, but the débris should be stirred a little to wet it if it is very dry. If there is a high wind, the leafhoppers in the débris may be killed by the waves, making the use of oil unnecessary. The danger to the vines from late re-flooding is serious. If the water has stood in the reservoir long enough to become warm, even this short reflow will hurt the buds, but fresh water held for 12 hours and moved on and off quickly is generally safe enough. The most usual remedy is to spray the bogs during the last 10 days of June. The treatments with a number of proprietary substances and their results are shown in a table. A commercial pyrethrum soap mixture containing 4·2 per cent. alcoholic extract of oleoresin of pyrethrum (1 lb. of which contained the extract of 5 lb. of pyrethrum flowers) mixed with 47 per cent. of soap gave satisfactory control when applied in a fine mist at high pressure, using 1 gal. to 160 gals. of water. At any weaker dilution it was much less effective. A home-made mixture of oleoresin of pyrethrum and coconut oil soap in the same proportions gave equally good results. As leafhoppers had been reported to be killed with Bordeaux mixture, a mixture in which the active ingredient is copper sulphate was tested but proved ineffective, confirming experiments with home-made Bordeaux conducted by the authors. Spraying should be effective even after the leafhoppers are full-grown. Pyrethrum spray does not apparently kill the insect unless it strikes it, it is therefore necessary to use large quantities and well cover the plants and to spray thoroughly all cranberry plants along the sides of ditches and the edges of the bog. A boom containing 3 or more nozzles with small holes proved the most effective ; 400 U.S. gals. of spray to the acre should be used.

McDaniel (E. I.). **Some common sucking Insect Pests of Evergreens.** —*Extens. Bull. Michigan State Coll. Agric.*, no. 76, 14 pp., 8 figs. [East Lansing, Mich.] February 1929. [Recd. 1930.]

This bulletin contains notes on the bionomics and control of the pests that have been the most troublesome in Michigan during the past five years in nurseries of evergreens and on recently transplanted conifers.

Much of the information on *Chermes* (*Adelges*) *abietis*, L., and *C.* (*A.*) *similis*, Gill, on spruce has already been noticed [*R.A.E.*, A, xv, 498 ; xvi, 524, etc.]. In the case of *C. similis* two distinct forms leave the sheltering galls early in July, *viz.*, nymphs that become winged individuals, which migrate and oviposit on neighbouring spruces, and wingless mature Aphids, which are fewer in number and may be found laying eggs both inside the galls and on the stems. The females of

C. (*A.*) *pinicorticis*, Fitch (pine bark aphis) probably overwinter on the pine, since their eggs are to be found on the trees early in the spring. The resulting Aphids form colonies on the bark and lower surface of the limbs and are covered with a white cottony material; from these colonies develop winged individuals, which spread to other trees. This Aphid may be successfully controlled just before growth starts in the spring by spraying at high pressure with 2 per cent. oil emulsion, lime-sulphur 32° Bé (1 : 8), or 1 lb. fish-oil soap to 8 U.S. gals. water. In summer, plain water, applied with enough force to wash the Aphids off the tree, or nicotine sulphate (1 U.S. pint to 100 U.S. gals. water and 4 lb. soap) is effective.

Chionaspis pinifoliae, Fitch (pine leaf-scale) attacks pine, spruce and other conifers. It has at least two generations a year. Hibernation occurs in the egg-stage, the number of eggs under each scale varying from 20 to 30. It can be easily controlled in spring by 2–3 per cent. oil emulsion. *Physokermes piceae*, Schr. (spruce bud scale), which infests several species of conifers, but is especially destructive to Norway spruce [*Picea excelsa*], overwinters as an immature female, having one generation a year. The eggs hatch in early June, and the young establish themselves on the new growth. In early spring the control is the same as for *C. pinifoliae*; and soon after the eggs hatch, nicotine sulphate as applied against *Chermes pinicorticis* will kill many of the young. *Toumeyella numismatica*, Pettit & McD., infests Scots pine [*Pinus sylvestris*]; there is apparently only one generation a year. The males appear in autumn and die after fertilising the females, which pass the winter as partly grown individuals on twigs and young branches. The injury is not confined to feeding alone, but is largely due to the abundance of honey-dew produced throughout the growing season, which closes the breathing pores of the plant and checks the development of the tree. No experiments against this scale were made, but it could probably be controlled by late dormant spraying with oil.

Paratetranychus ununguis, Jac. (spruce mite), which attacks a variety of conifers [xiii, 59], may be controlled in the growing season by spraying with $1\frac{1}{2}$ lb. glue to 10 U.S. gals. water.

Record of Current Work, April 1 to June 30, 1929.—*U.S. Dept. Agric., P.C.Q.A., S.R.A.*, no. 99, pp. 50–61. Washington, D.C., December 1929.

An account is given of the situation in the United States with regard to the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], which was discovered in Florida in April 1929; the gipsy moth [*Porthetria dispar*, L.]; the European corn borer [*Pyrausta nubilalis*, Hb.]; the Japanese beetle [*Popillia japonica*, Newm.]; the pink bollworm [*Platyedra gossypiella*, Saund.]; and the date-scale, *Parlatoria* [*blanchardi*, Targ.]. The Mexican fruit-worm [*Anastrepha ludens*, Lw.] has regained a foothold in the lower Rio Grande Valley of Texas, two infestations being found in packing houses after almost two years' apparent absence [*cf. R.A.E.*, A, xviii, 66]. Subsequent examination showed that the premises of 10 growers were involved. This was probably due to the extension (to include the month of March) of the period allowed for harvesting the citrus crop; this extension will not be permitted again. The fruit on the infested properties was destroyed, and strict quarantine of the district was enforced.

Instructions to Inspectors on the Disinfection of Nursery Products for the Japanese and Asiatic Beetles (P.Q.C.A.—224). Supplement no. 1 (P.Q.C.A.—239).—*U.S. Dept. Agric., P.Q.C.A., S.R.A.*, nos. 99 & 100, pp. 63–76 & 133–134. Washington, D.C., December 1929 & January 1930.

The latest methods of disinfection of various nursery products and soil against the immature stages of the Japanese beetle [*Popillia japonica*, Newm.] and the Asiatic beetles [*Anomala orientalis*, Waterh., and *Aserica castanea*, Arrow] are described for guidance in carrying out treatments as a basis for certification under the regulations of Quarantines 48 and 66. [The latter quarantine, directed against the Asiatic beetles, has, however, since been repealed (*R.A.E.*, A, xviii, 272).]

Potting soil may be fumigated with carbon bisulphide in a gas-tight box or bin. The soil must be friable and loosely thrown into the box ; it may be dry or moist, but not wet. Its temperature must be at least 45° F. when the treatment is applied and must not fall below 40° during the 48 hours or more of fumigation. The dosage is 1 lb. (350 cc.) carbon bisulphide to 1 cubic yard of soil. The method is to place 18 ins. of soil loosely in the box and fumigate with 176 cc. to each sq. yd., distributed uniformly in holes 2 ins. deep and 18 ins. apart, using 44 cc. to each hole and filling the holes with soil immediately after injection. Another 18 ins. of soil is then put in and treated until the box is filled. Soil of similar condition may be treated with 5 lb. flake naphthalene (free from tar) to each cubic yard, the flakes being spread over and thoroughly mixed with the soil by shovelling over at least three times. The soil must remain undisturbed for a week after treatment, and its temperature must not drop below 50° F. Friable soil may also be treated with steam generated under 70 lb. pressure and properly dispersed through the soil, which must be heated throughout to 130° F. and maintained at that temperature for 30 minutes. Acid lead arsenate is recommended only for friable soils that are slightly acid or neutral in action, using 2 lb. to each cu. yd. and uniformly mixing with a shovel or machine mixer. Eight weeks' treatment with the soil at a temperature of at least 60° F. is necessary to ensure the death of all grubs. In the field, soil of similar condition may be treated with 1,500 lb. of lead arsenate to each acre, or 35 lb. to 1,000 sq. ft., treatment being applied before 1st August for certification between 15th October and 15th June. Details of the method of application for plants grown in rows and for individual plants are given.

For the disinfection of sand, soil, earth, peat compost and manure for shipment outside the regulated areas, the only method authorised as a basis for certification is fumigation with carbon bisulphide, by the method described above.

For soil in and around plots, cold-frames, hot-beds, etc., one treatment prescribed is powdered lead arsenate as for use in the field. The soil should be ploughed and harrowed until it is in good tilth, and the poison mixed with 10 times its volume of dry soil, sand or other filler, and applied with a fertiliser drill or broadcast by hand. It will probably be several weeks before infestation is eliminated, and the soil should not be used until at least eight weeks after treatment. Another treatment is fumigation with carbon bisulphide, as for potting soil, the dose being 6 lb. to each 100 sq. ft. of surface, applied in holes 12 ins. apart and 1 to 2 ins. deep, 21 cc. being used in each hole, which is then filled with soil After this, the whole surface is kept covered

for 48 hours with a tarpaulin or other air-proof cover. This treatment should not be applied when adult beetles are present, and a warm, humid atmosphere, without wind, is preferable. A 35 per cent. miscible carbon bisulphide emulsion [*R.A.E.*, A, xvii, 513] may be used under the same conditions on any kind of soil provided that the surface is level and the drainage such that it will not disappear from the surface in less than 10 minutes, but will all be absorbed within 5 hours. Each 97 cc. of the emulsion must be diluted in 10 U.S. gals. of water, this being sufficient for 4 sq. ft. of soil. The application is made by means of 24 gauge galvanised iron collars 10 ins. wide and not more than 4 ft. square. These are forced 3 ins. into the soil side by side, and the emulsion is poured into the basins formed by the collars ; as soon as the liquid has disappeared from the surface, the collars may be lifted and set in another position. The soil must not be disturbed for 48 hours after treatment. Naphthalene may also be used if the soil is dry and friable, using 1,000 lb. to the acre or 23 lb. to 1,000 sq. ft. The naphthalene must be mixed with 10 times its volume of dry soil and broadcast over the surface and then harrowed and cross-harrowed until well mixed in. This should be done when no adult beetles are present, and the temperature of the soil at a depth of 6 ins. should not be less than 50° F. for a week after treatment.

Disinfection of the soil about the roots of plants may be done in a variety of ways, and a long list is given of many kinds of plants with notes on the kind of treatment most suitable for each. Washing all soil from the roots with water is satisfactory if done with absolute thoroughness ; the plant should be in a dormant or semidormant condition, the roots should be pruned as much as possible, and after washing, the crevices in the roots should be examined with a knife and wire for any larvae left. Dormant plants may also be treated by immersing the roots in hot water for 70 minutes after the root masses have attained the water temperature of 112° F., which must be maintained uniformly throughout the time ; after treatment the plants should be cooled slowly to room temperature. Plants may be dipped when dormant or semi-dormant in the carbon bisulphide emulsion referred to above, diluted at the rate of 65 cc. to 10 U.S. gals., in which they should be immersed for 24 hours at approximately 70° F. The plants should be at a temperature of about 60° F. before treatment and should have the loose soil shaken from them ; the roots should be pruned and somewhat dried if necessary, and the diameter of the balls should not be more than 6 ins.

This emulsion can also be employed in the field ; in this case the amount used depends on the size and shape of the iron collars and on the temperature of the soil. A series of tables enables the correct amount to be estimated.

Robinson (R. H.). **Sprays, their Preparation and Use.**—*Sta. Bull. Oregon Agric. Expt. Sta.*, no. 259, 27 pp., 1 chart. Corvallis, Ore., February 1930.

An outline is given of proved methods for the preparation of home-made insecticides and fungicides, emphasising the precautions that should be taken in order to ensure the best results. The physical and chemical properties of the different commercial products, their stability,

effectiveness and compatibility with other sprays are discussed. A chart shows the combinations of the more important insecticides and fungicides recommended for use in Oregon [*cf. R.A.E.*, A, xv, 184].

Robinson (R. H.). **New Solvents for the Removal of Arsenical Spray Residue.**—*Indust. Engng. Chem.*, xxi, p. 1132 (reprint 9 pp.). Easton, Pa., November 1929.

The following is the author's summary:—

The action of aqueous solutions of different classes of compounds and combinations of compounds as solvents for lead arsenate spray residue has been studied. No one compound was found superior to hydrochloric acid for removal of the spray residue. Combinations of certain sulphates or chlorides with hydrochloric acid dissolve far larger amounts of lead arsenate than hydrochloric acid alone, when the acid was used in equivalent concentrations. Furthermore, the solvent action rapidly reaches its maximum since little more, if any, of the lead arsenate dissolves in 30 minutes than in 5 minutes. The combination of sodium sulphate and hydrochloric acid appears to be the most practical of those studied. On account of the few commercial washing tests completed thus far, general recommendations cannot be made at this time. The results obtained, however, warrant further commercial tests to learn whether the combinations may be advisable.

Barnes (J. W.) & Murray (C. W.). **Sampling cleaned Apples for Determination of Arsenical Spray Residue.**—*Indust. Engng. Chem.*, xxi, p. 1146 (reprint 4 pp.). Easton, Pa., November 1929.

Analysis of the variations in arsenical residue on individual apples that have been cleaned in standard apparatus by ordinary commercial methods, some being washed in acid solution and others wiped with a revolving brush, showed that for apples carrying not more than 0·01 grain arsenic trioxide per lb. a sample of six apples taken from a lot, all parts of which had the same treatment, will give an accuracy of $\pm$ 0·0015 grain per lb. The amount of arsenic was determined by the more recent modifications of the Gutzeit method.

Gersdorff (W. A.) & Davidson (W. M.). **New Solvents for the active Principles of Pyrethrum.**—*Indust. Engng. Chem.*, xxi, p. 1251 (reprint 6 pp.). Easton, Pa., December 1929.

Owing to the fact that a kerosene extract of pyrethrum has several characteristics, such as combustibility, immiscibility with water and injurious action on the foliage of plants, which restrict its uses, investigations were conducted to find solvents that are free from these disadvantages. Various solvents, some miscible with water and some immiscible, some inflammable and others not, were found to remove the active principle of pyrethrum completely. Many of these vehicles are suitable for application on plants as resistant as cabbage because they do not injure the foliage, whereas kerosene causes such severe injury that it is unsuitable. At 5 per cent. concentrations almost all the extracts tested gave effective control of *Myzus persicae*, Sulz., without injury to cabbage. If cost is taken into account, denatured ethyl alcohol appears to be the best solvent when the extract is to be

diluted with water for application on plants. There is no advantage in the extraction of pyrethrum with these solvents at their boiling point temperatures over that at room temperature.

Young (H. D.). **Evolution of Hydrocyanic Acid from Calcium Cyanide.**—*Indust. Engng. Chem.*, xxi, p. 861 (reprint 5 pp.), 4 charts. Easton, Pa., September 1929.

In greenhouse fumigation, there is practically always sufficient moisture present to liberate all the combined hydrocyanic acid from calcium cyanide, but in bulb fumigation on the Pacific Coast this is not the case. Experiments have therefore been made with four different commercial brands of calcium cyanide to determine how much water vapour is required to liberate the hydrocyanic acid present. The results are shown in charts, the variations in the different brands being probably due to difference in degree of fineness of the material. It was found that with any brand the rate of evolution of hydrocyanic acid increases with increasing relative humidity. With a calcium cyanide of which 80 per cent. will pass through a 200-mesh sieve, commercially satisfactory evolution of hydrocyanic acid (that is, 90 per cent. or more) will occur in about 2 hours with a relative humidity of 50 per cent. or above.

Clark (E. P.). **The Occurrence of Rotenone in the Peruvian Fish Poison " Cube."**—*Science*, lxx, no. 1820, pp. 478–479, 2 refs. New York, N.Y., 15th November 1929.

In addition to *Derris* spp. [*cf.* *R.A.E.*, A, xvii, 450], rotenone has also been isolated from *Lonchocarpus* [*cf.* xiv, 512], *Milletia taiwaniana*, *Mundulea suberosa* and *Ormocarpum*. Among the poisonous plants that have recently attracted attention as insecticides is the Peruvian fish-poison " cube," which is the root of an unidentified plant, probably *Tephrosia piscatoria*. Two samples of this material gave 7·2 and 7·1 per cent. of crude rotenone, which on recrystallisation was identical as regards melting points and optical properties with pure rotenone.

Roark (R. C.). **Recent Mothproofing Patents.**—*Textile Colorist*, li, no. 612, pp. 828–830 ; lii, no. 613, pp. 25–28. Philadelphia, Pa., December 1929 & January 1930.

It is estimated that damage to the amount of £20,000,000 is caused in the United States each year by clothes moths, carpet beetles and other insects attacking silk, woollen and mohair fabrics, furs, feathers and other materials of animal origin. The author reviews a large number of recent patents in various countries on moth-proofing materials.

Bruère (P.) & Worms (G.). **Protection durable des laines contre les mites par une méthode de teinture réalisable sans colorants.**—*C.R. Acad. Agric. Fr.*, xvi, no. 6, pp. 204–208. Paris, 1930.

The impregnation of woollen goods and furs with various substances as a protection against the attacks of *Tineola* (*Tinea*) *bisselliella*, Humm. (clothes moth) and *Tinea pellionella*, L. (fur moth) has frequently been tried without much success, the best of those used having

the disadvantage of washing out in time. The authors have discovered a new form of colourless dye obtained by using metallic soluble salts subjected, in the optimum acid medium, to the action of sodium nitrite. This has been tested during the past three years, with the result that 30 per cent. of the larvae placed on treated wool failed to develop, and that any females developing on it were sterile. The immunity from infestation remains after any treatment of the wool, such as washing, chlorination, etc. The impregnation also prevents imitation furs from causing dermatitis.

Cuarantena núm. 1, para el control de la plaga del gusano rosado del algodonero. [Quarantine No. 1 for the Control of the Pink Bollworm of Cotton.]—*Bol. mens. Defensa agríc., Sec. Agric. Fom., México*, iii, no. 5–8, pp. 157–163. S. Jacinto, D.F., 1929.

This is a revision of a previous quarantine against the spread of *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in Mexico [*R.A.E.*, A, xvi, 162].

Acuerdo por el cual se establece cuarantena absoluta contra toda clase de frutas de pericarpio blando y productos de hortaliza. [Resolution establishing an absolute Quarantine against all Fruits with soft Pericarps and Vegetables.]—*Bol. mens. Defensa agríc., Sec. Agric. Fom., México*, iii, no. 5–8, p. 164. S. Jacinto, D.F., 1929.

This resolution modifies part of External Quarantine no. 5 [*R.A.E.*, A, xv, 636] to prohibit the introduction of host-fruits, etc., of the Mediterranean fruit-fly, *Ceratitis capitata*, Wied., from countries where it occurs.

Acuerdo por el cual se prohibe el tráfico y venta de tubérculos y frutas atacadas por las plagas de diversos barrenadores de la papa, " mosca mexicana de la fruta " y " escama roja " de la naranja. [Resolution prohibiting Traffic in and Sale of Tubers and Fruits attacked by various Potato Borers, Mexican Fruit-fly, and Red Scale of Orange.]—*Bol. mens. Defensa agríc., Sec. Agric. Fom., México*, iii, no. 5–8, pp. 165–166. S. Jacinto, D.F., 1929.

The pests against which this measure is directed are [*Epicaerus cognatus*, Sharp] and other potato borers ; *Anastrepha ludens*, Lw. ; and the red scale of orange [*Chrysomphalus aurantii*, Mask.].

Cook (W.). **Some feeding Experiments undertaken in Trinidad with** *Liothrips urichi* (**Karny**).—*Agric. J. Fiji*, ii, no. 4, pp. 85–92. Suva, 1929.

In view of the proposed introduction of *Liothrips urichi*, Karny, into Fiji for the control of *Clidemia hirta* [*cf.* *R.A.E.*, A, xvi, 602], experiments were made to test the possibility of its adapting itself to economic plants. The technique of the work is described. The tests were made with first and second instar larvae and adults of both sexes, and over twenty species of plant were used, but in no case did the thrips adapt itself to them. The insects died in 4–14 days, and the adults did not oviposit. Only larvae that were placed on the plants

when ready to pupate succeeded in doing so. The experiments indicate that the feeding stages of this thrips cannot exist on any plant other than *C. hirta*.

CAMPOS R. (F.). **Una especie de *Dryocoetes* perjudicial a la tagua.** [A Species of *Dryocoetes* injurious to *Phytelephas macrocarpa*.]—*Rev. Col. nac. Vicente Rocafuerte*, xi, no. 36–37, pp. 63–65. Guayaquil, 1929.

A Scolytid closely allied to *Coccotrypes* (*Dryocoetes*) *dactyliperda*, F., which is known as a serious pest of the vegetable ivory palm, *Phytelephas macrocarpa*, has been found attacking the nuts of this palm in Ecuador, both in nature and after they have been manufactured into buttons, etc.

LIMA (A. da Costa). **Sobre o *Pseudococcus cryptus* Hempel (Homoptera: Coccoidea), praga do cafeeiro e da laranjeira.** [*P. cryptus*, a Pest of Coffee and Orange.]—*Mem. Inst. Oswaldo Cruz*, xxiii, no. 1, pp. 35–39, 2 pls., 8 refs. Rio de Janeiro, 1930.

The Coccid found in galls on the roots of coffee in Pernambuco and believed to be *Pseudococcus citri*, Risso [*R.A.E.*, A, xvi, 382, 501] is now shown to be *P. cryptus*, Hempel, as a result of comparison with individuals obtained from roots of orange. The antennae of this species are described.

POPE (J. B.). **Factores que determinan el control del "Arrebiatado" del algodonero en los valles de Lima, Huacho y Cañete.** [The Factors checking the Cotton Stainer in the Valleys of Lima, Huacho and Cañete.]—*La Vida agric.*, vii, no. 75, pp. 85–86. Lima, February 1930.

Dysdercus ruficollis, L., is a serious pest of cotton in some parts of Peru, but in others little harm is done, owing to the cultural methods practised. The destruction of the old plants and the sowing of the new crop occur within a period of three months. In August, at the beginning of this period, stainers in all stages were found to be flourishing, and if cotton in the producing stage had been present, the same losses would have been caused as are recorded elsewhere. At the end of the period, in October, though the bugs were still abundant, they showed clear evidences of malnutrition. The cultivation of the plants immediately after they are cut back results in the levelling of the ridge between them, and many stainers are covered with soil and killed. In irrigation, the practice is to let water flow in the seed furrows as soon as the plants are a fortnight old. This covers the ground with a layer of soil and destroys the young nymphs and eggs about to hatch. The result is not so satisfactory if irrigation be delayed until the bugs are plentiful, because many individuals save themselves by crawling up the plants.

[**Reports of the**] **Bureau of Sugar Experiment Stations.**—*Queensland Agric. J.*, xxxiii, pt. 2, pp. 94–99. Brisbane, 1st February 1930.

Adults of the greyback beetle [*Lepidoderma albohirtum*, Waterh.] were observed by E. Jarvis to be strongly attracted to electric light.

This reaction usually lasted only a minute or so, and the beetles then became quite motionless and unresponsive to phototropic influences. They remained in this condition for hours, although in some cases they had settled only 3–4 ins. from an electric lamp.

Many of the shoots of ratoon cane infested with wireworms wilt and turn brown or dry up. Examination frequently reveals the presence, just beneath the surface of the soil, of an irregular cavity gnawed through the soft rind and extending in some cases to the centre of the shoot, causing the death of the heart leaves. A bait of chopped grass, dipped in a solution of 1 lb. sodium arsenite and 8 lb. molasses in 10 gals. water, is recommended against the adult beetles. Cultural measures consist in increasing the humus content of the soil, ploughing deeply and collecting the wireworms before planting, and thoroughly draining and working the land, particularly in low-lying areas with little natural drainage.

R. W. Mungomery points out that the farms in the Bundaberg district that have been most severely infested with cane grubs are those on which, or adjacent to which, it has been the custom to grow ratoon crops for a number of years. As a rule, old stools are the most severely damaged, and as they constitute a favourable breeding-place for the beetles, they are also the sources of infestation for younger cane in the vicinity. For this reason it is recommended that land should be ploughed and prepared for a new crop after the harvesting of the second ratoons.

A. N. Burns reports several outbreaks of *Pentodon australis*, Blkb. (black stem gouger) in the Mackay district. The effect on the cane was similar to that caused by attacks of larvae of *Lepidiota frenchi*, Blkb., but the heart leaves were more withered, probably owing to the fact that the larvae of *P. australis* bore into the shoots below the surface of the soil or into the sets themselves, and seldom attack the fibrous roots on which the other species feeds. In some cases as many as 4 and 5 third-stage grubs were found inside the sets. The life-cycle is comparatively short, the larval stage lasting a few weeks and the pupal stage about three weeks only. There are probably several generations in a year in this district [*cf. R.A.E.*, A, xvii, 353], although the generation occurring in the spring seems the only one that causes serious injury. Outbreaks do not appear to be general every year, and the areas subject to attack are usually small, infestation on the farms inspected being confined to hollows in the fields or areas where silt had been deposited by rain water. *P. australis* is rare in the Cairns district, but is commonly found in the Mackay, Bundaberg, Maryborough and Brisbane areas. The third-stage larva, pupa and adult are very briefly described. Should control measures become necessary, fumigation as used against the larvae of *Lepidoderma albohirtum* is suggested. Sets for replanting infested areas should be dipped in a solution of sodium arsenite, molasses and water and planted while wet.

The attacks of an Aleurodid, possibly *Neomaskellia* (*Aleurodes*) *bergi*, Sign., combined with the extremely dry weather conditions, caused many plants to turn yellow. Ants, probably belonging to the genus *Cremastogaster*, were associated with it and probably protect it from its natural enemies. Eggs are laid in groups on the lower surface of the older cane leaves. The adults are very active, and fly from the cane when disturbed. While feeding, they congregate in small groups

on the lower surface of the leaves. As only the outer leaves are attacked, the cutting off and burning of the older leaves is suggested as a remedial measure. The adult is briefly described.

JARVIS (E.). **Annual Report of the Entomologist at Meringa 1928-1929.** —*29th Ann. Rep. Bur. Sugar Expt. Stas. Queensland*, pp. 37–40. Brisbane, 1929.

Some of the investigations on sugar-cane pests carried out in the season 1928–29 have already been noticed [*R.A.E.*, A, xvii, 242, 354]. Although the phototropic reaction of *Pseudoholophylla furfuracea*, Burm., is slight, *Lepidoderma albohirtum*, Waterh., is strongly attracted to artificial light. In November a light trap was fitted with an electric lamp of 32 candle power, in order to determine whether such a light would prove as attractive as an acetylene lamp. The trap was placed close to a fig tree (*Ficus benjamina*), on which numbers of *L. albohirtum* were feeding. In less than two hours 80 beetles were captured, of which 41 were females. Setting the lamp in a deeply concave reflector of about 8 inches diameter did not, apparently, make the light more attractive.

BURNS (A. N.). **Report of the Assistant Entomologist [at Mackay] for the Year ending 31st October 1929.**—*29th Ann. Rep. Bur. Sugar Expt. Stas. Queensland*, pp. 40–45. Brisbane, 1929.

The damage caused by the more important pests of sugar-cane in the Mackay District during the summer of 1928–29 is briefly reviewed. Observations showed that carbon bisulphide used as a soil fumigant against cane grubs loses its poisonous properties after it has been in the ground for 40–48 hours, and an infestation a fortnight after fumigation was found to be due to migration to the cane roots of grubs that were feeding on grass roots between the cane rows. With a view to finding a fumigant that would kill quickly and at the same time retain its poisonous or repellent properties for some weeks, experiments were carried out with solutions of pine tar creosote with benzine, carbon bisulphide, etc., but the results were inconclusive. Some details are given on the bionomics of the following cane beetles and associated species ; the Melolonthids, *Lepidoderma albohirtum*, Waterh. (greyback beetle), *Lepidiota trichosterna*, Lea, and *L. frenchi*, Blkb. ; the Dynastid, *Dasygnathus australis dejeani*, Macl. (dusky cane beetle) ; and the Rutelids, *Anoplognathus boisduvali*, Boisd. (Christmas beetle), *A. porosus*, Dalman (allied Christmas beetle), *A. pallidicollis*, Blanch., *A. abnormis*, Macl., *Anomala antiqua*, Gyll. (*australasiae*, Blkb.), *Caloodes rayneri*, Macl., *Anoplognathus parvulus*, Waterh. (*C. mastersi*, Macl.), and *Repsimus aeneus*, F.

MUNGOMERY (R. W.). **Report of the Assistant Entomologist [at Bundaberg] for the Year ending 31st October 1929.**—*29th Ann. Rep. Bur. Sugar Expt. Stas. Queensland*, pp. 45–46. Brisbane, 1929.

Both ordinary and coloured lights have proved ineffective for attracting females of *Pseudoholophylla furfuracea*, Burm. In the southern districts, lights are chiefly valuable as a means of finding

pairing adults of *Lepidiota frenchi*, Blackb., which may readily be collected from low shrubs and fences. *P. furfuracea* and *L. trichosterna*, Lea, pair on the ground shortly after emergence, and are difficult to find as they resemble the soil in colour.

Carbon bisulphide and paradichlorobenzene are most effective as soil fumigants in the hot spring and summer months, for in winter the diffusion of the gas is very rapid owing to high winds, and in the case of paradichlorobenzene, particularly, the liberation of toxic vapours is not rapid enough to kill grubs before they can move away. With carbon bisulphide, the radius of the spread of the gas is greatly reduced in winter and to be efficient a much larger quantity must be used, making the cost almost prohibitive.

A brief account is given of a minor outbreak of *Crambus malacellus*, Dup., [*R.A.E.*, A, xvii, 417].

KLEMM (M.). **Beitrag zur Morphologie und Biologie der** *Epilachna chrysomelina* **Fabr. (Coleopt.).** [A Contribution to the Morphology and Biology of *E. chrysomelina*.]—*Z. wiss. InsektBiol.*, xxiv, no. 9–10, pp. 231–251, 3 pls., 14 figs., 19 refs. Berlin, 1st February 1930.

The Coccinellid, *Epilachna chrysomelina*, F., occurs in southern Europe and also in South Germany, but does little harm to plants there. In Turkestan it is a serious pest of cucurbits. Breeding experiments in Berlin were conducted with beetles obtained from Corfu and fed on leaves and fruits of pumpkin and cucumber. The egg, larva and adult are described, and an account is given of the biology as observed in the laboratory. The characters differentiating *E. angusticollis*, Reiche, from *E. chrysomelina* are described from living specimens from Spain.

VOSS (E.). **Eine** *Rhynchites*- **Art als Schädling an** *Cinnamomum camphora* **(Col., Curc.).** [A Species of *Rhynchites* as a Pest of *C. camphora*.]—*Z. wiss. InsektBiol.*, xxiv, no. 9–10, p. 256. Berlin, 1st February 1930.

Rhynchites cinnamomi, sp. n., is described from Java, where it damages the young branches of camphor (*Cinnamomum camphora*).

BEGEMANN (H.). **Over schildluizen van de koffie.** [On Coccids infesting Coffee.]—*Meded. Proefst. Malang*, no. 71, 54 pp., 27 figs., 20 refs. Malang, 1929. Reprinted from *Arch. Koffiecult.*, iii, no. 3. Batavia, December 1929.

The object of this bulletin is to collate the known facts regarding the Coccids infesting coffee in the Dutch East Indies. The most injurious are the white coffee mealybug, the white root mealybug (probably *Pseudococcus citri*, Risso), which is, however, not abundant, the white lamtoro mealybug (*Ferrisia virgata*, Ckll.), *Coccus viridis*, Green (green coffee scale) and *Saissetia coffeae*, Wlk. (*haemisphaerica*, Targ.) (brown scale). Brief descriptions are given of the female of *C. viridis* and of both sexes of *F. virgata* and of the white coffee mealybug, which has usually been recorded as *P. citri*, but which may be *P. lilacinus*, Ckll. [*cf. R.A.E.*, A, xvi, 308]. Other white mealybugs also occur on coffee,

including *P. crotonis*, Green, and *P. adonidum*, L., but are of little importance.

The bionomics and control of the white coffee mealybug, *F. virgata* and *C. viridis* are discussed. In the case of the mealybugs, development from egg to adult requires 5–6 weeks. The food-plants of *F. virgata* include *Calopogonium*, *Erythrina*, *Hevea*, coffee, *Leucaena glauca* and *Tephrosia*. It is independent of ants as is apparently the white coffee mealybug, at any rate in the Dutch East Indies [*cf. loc. cit.*]. Both mealybugs are most abundant in the dry season, and cause injury of various kinds to the flowers, berries and leaves. A loss of £10,000 appears to have occurred in one heavily infested plantation in 1928. *Coccus viridis*, the male of which is unknown, requires at least 65 days for development. It is probable that the fall of very young berries, attributed to the berry borer [*Stephanoderes hampei*, Ferr.], is largely due to this scale. It also retards the growth of young bushes. It is fostered by ants, and measures against them are of considerable value in its control. The most important is *Plagiolepis longipes*, Jerd., which may be attracted into trenches half-filled with leaf-litter, and there poisoned by strewing calcium cyanide dust.

Bunting (B.) & Milsum (J. N.). **The Culture of Vegetables in Malaya.**—[*Bull.*] *Dept. Agric. S.S. & F.M.S.*, Gen. Ser. no. 1, 78 pp., 12 pls. Kuala Lumpur, 1930.

Brief notes are given on the more important insect pests of vegetables in Malaya. *Prodenia litura*, F., deposits large masses of eggs on the leaves of Bambara groundnut (*Voandzeia subterranea*), cowpea (*Vigna catjang*), tomato and cabbage, the larvae feeding together for a few days and then dispersing. Hand-picking the egg masses and lead arsenate sprays when the larvae are clustered together are the measures recommended. The larvae of *Lamprosema diemenalis*, Guen., occur in large numbers on cowpea, pigeon pea (*Cajanus indicus*) and soy-bean (*Glycine hispida*) and defoliate the plants; they can be controlled by lead arsenate sprays. *Hellula undalis*, F., feeds on radish and cabbage in the larval stage, spinning a web round the leaves. For this pest, and for *Sylepta derogata*, F., on ladies' fingers (*Hibiscus esculentus*), *Leucinodes orbonalis*, Guen., on brinjal (*Solanum melongena*), *Crocidolomia binotalis*, Zell., on kohlrabi, and *Pyrausta salentialis*, Snell., boring in maize stems, the only really satisfactory measure is the destruction of infested plants. *Cylas formicarius*, F., oviposits in small holes in sweet potato tubers, which should be well covered with soil when planting to protect them from attack. The tubers should be gathered in good time, and infested ones should not be left in the ground; boiling destroys both beetles and grubs in them, and they can then be used as cattle food. *Epilachna indica*, Muls., feeds on the leaves of various vegetables in both larval and adult stages and can be controlled by lead arsenate sprays mixed with soap. The grubs of *Ceratia coffeae*, Hrnst., are said to feed at the roots of their food-plants, but very little is known of their life-history. Adults can be collected on sweet potato and cucurbits early in the morning, when they are sluggish, or the plants may be dusted with a stomach poison. Maggots of the fruit-flies, *Dacus* (*Chaetodactus*) *cucurbitae*, Coq., *D.* (*C.*) *caudatus*, F., and *D.* (*C.*) *ferrugineus*, F., cause rotting of the fruits of cucurbits, and as a protection these should be covered with cloths or paper. The bugs,

Physomerus grossipes, F., and *Anoplocnemis phasiana*, F., on various vegetables and *Dysdercus cingulatus*, F., on *Hibiscus esculentus* should be destroyed by knocking them from the food-plant into a tin containing water and kerosene. Lists of minor pests are given under the heading of the crop they infest, showing the part of the plant attacked, and notes on the preparation and use of insecticides are appended.

GOLDING (F. D.). **A Vector of Leaf Curl of Cotton in Southern Nigeria.**—*Emp. Cott. Grg. Rev.*, vii, no. 2, pp. 120–126, 5 refs. London, April 1930.

As a result of experiments in Southern Nigeria, it was found that an unidentified Aleurodid is able to transmit leaf-curl from diseased cotton plants to healthy ones. The disease appeared in 11–24 days from the time the Aleurodids were placed on the plants. On completion of the experiments, weekly counts of the adult Aleurodids and estimates of the incidence of leaf-curl on a resistant strain of cotton were made. It was observed that the disease was most prevalent (1·7 per cent. of the plants infected) on plots with the largest population of Aleurodids, in which cotton was grown with ground-nuts, an alternative food-plant of the whiteflies. Counts on a less resistant variety showed that although Aleurodids were far less abundant (8 adults to each 50 leaves) almost the same percentage of plants developed leaf-curl as in the case of the resistant variety. It is probable that the resistant strain of cotton owes its comparative freedom from leaf-curl to the repellent effect of its pubescent foliage. The Aleurodids were present on the plants in all months of the year except December and January. Negative results were obtained in tests to determine whether the Jassid, *Empoasca facialis*, Jac., is able to transmit the disease. Of nineteen plants heavily infested by a colony of Aphids, one ultimately developed leaf-curl.

Coffee Borer Beetle in India.—*The Times*, London, 2nd July 1930.

Investigations, following the discovery that one Mysore estate has been infested with coffee berry borer [*Stephanoderes hampei*, Ferr.], hitherto unknown in India, have proved that 26 widely scattered estates in southern India have been infested. As only dead beetles have been found, it is hoped that the long Indian drought has proved less favourable to the beetle than conditions in Java and Brazil, where it has caused heavy losses. At a meeting of the Madras and Mysore Government authorities with the planters of Bangalore, it was decided that a special investigation was necessary in all coffee districts.

MEILHAN (J.). **Un parasite du tabac : le** *Lasioderma serricorne* **Fabricius.**—*Rev. Zool. agric. appl.*, xxviii, nos. 10 & 11, pp. 145–153 & 168–174, 5 figs. Bordeaux, October & November 1929.

This account of *Lasioderma serricorne*, F. (tobacco beetle), which has caused heavy losses to a firm that exports cigarettes and cigars from Algeria to Indo-China, is based on one already noticed [*R.A.E.*, A, vii, 366]. It is shown that the tobacco is infested in Algeria before shipment.

Feytaud (J.). **La défense contre les insectes de la vigne.**—*Rev. Zool. agric. appl.*, xxviii, no. 11, pp. 161–167. Bordeaux, November 1929.

The author reviews the principal vine pests, which have recently been estimated to total about 500 species. The most troublesome in the south-west of France are white grubs, bud-cutting weevils, *Haltica ampelophaga*, Guér., which the author considers a synonym of *H. lythri*, Aub., Coccids, *Sparganothis pilleriana*, Schiff., *Clysia ambiguella*, Hb., which is now, however, abundant in only a few vineyards, and *Polychrosis botrana*, Schiff., which is more or less common everywhere. Successful remedies are known for each of these ; what is lacking is organisation and co-operation in defensive measures. Spraying is now essential, especially against *Haltica* and the Lepidoptera. The sprays consist of insoluble arsenicals, nicotine and pyrethrum-soap, the relative value of these being discussed. Against *Haltica*, three sprays at least are necessary, the first during oviposition and the second and third during the development of the larvae, the spray being directed to the lower surface of the leaves. Against *P. botrana*, the simplest effective campaign consists of one or two applications against the first generation (generally at the end of May) and one against the second generation (20th–25th July). The exact date for application is best determined by local observation, and it is suggested that one observer might act for many growers. The establishment of local organisations in touch with the regional stations for this purpose is very desirable.

Poutiers (R.). **Sur le comportement du** *Novius cardinalis* (**Coléoptère Coccinellide**) **vis-à-vis de certains alcaloïdes.**—*C.R. Soc. Biol.*, ciii, no. 12, pp. 1023–1025. Paris, 1930.

The acclimatisation and distribution of *Novius cardinalis*, Muls., against *Icerya purchasi*, Mask., in the French Riviera has proceeded satisfactorily. It has, however, been noticed that the scales were not attacked when they infested *Spartium junceum* and other species of broom [*cf. R.A.E.*, A, xviii, 262]. To find the cause of this, equal numbers of *N. cardinalis* were placed in two cages, which contained Coccids removed from *Pittosporum tobira* and *S. junceum* respectively. The scales from *Pittosporum* were destroyed by the Coccinellids, and the females of the latter oviposited, whereas the scales from *Spartium* remained untouched, and all the Coccinellids died from starvation without ovipositing. As the Coccids were kept in the cages without their food-plants, the author concludes that the repellent property is due to alkaloids obtained from the broom and remaining in the fat-body. This property is not transmitted to the next generation ; *N. cardinalis* readily attacked scales that had originated from parents fed on *S. junceum* and had been placed on *Pittosporum* as larvae.

The author points out the danger that *S. junceum* and *Genista*, which are grown as ornamental plants, may serve to protect colonies of *I. purchasi*, which may then easily establish themselves on other plants.

Séguy (E.). **Un nouveau parasite de l'abeille domestique.**—*Encyc. ent.*, Sér. B, II. Dipt., v, pp. 169–170, 4 figs. Paris, 1929 [1930].

The second and third stage larvae of a Tachinid, *Myiapis angellozi*, sp. n., are described from the south of France, where they were found parasitising the adults of the honey bee. The young larvae live in the

thorax of the host, which is soon killed, and the third stage larvae feed in the dead tissues. The soil in front of the hives, where pupation apparently takes place, should be treated with an insecticide, and dead bees from infested hives should be burnt or chemically treated.

VITZTHUM (H.). **Acarologische Beobachtungen. (14. Reihe.)** [Acarological Notes. (14th Series.)]—*Zool. Jahrb.*, Abt. Syst., lix, no. 2–3, pp. 281–350, 41 figs. Jena, 3rd May 1930.

The genus *Dolaea* is revised, and descriptions are given of 3 new genera and 7 new species of Acarids from nests of stingless bees in Colombia. The mite, *Melittiphis alvearius*, Berl., a parasite of the honey bee in Italy, is not of wide distribution in Germany and has probably been accidentally introduced.

Eurygaster **Spp. and the Damage caused to Cereal Crops in different Countries.**—*Int. Bull. Plant Prot.*, iv, no. 2, pp. 22–25. Rome, February 1930.

No injury to cereals by *Eurygaster* has been recorded from England, Canada, Hungary, Morocco, Greece and Palestine, in all of which countries one or more species of the genus occur. *E. maura*, L., and *E. hottentota*, F., occur in Belgium. They are of little, if any, economic importance on cereals, but measures recommended are catching with sweeping nets, the use of grasses, which are preferred, as trap-crops, and spraying with pyrethrum. In Spain *E. maura*, *E. austriaca*, Schr., and *E. hottentota* var. *maroccana*, F., do occasional, but not serious damage to wheat, late sowings being always more injured than early ones. Another Pentatomid, *Aelia rostrata*, Boh., is the only bug of real importance in Spain as a pest of wheat. Bushes near the fields should be sprayed with an inflammable liquid and burnt, as the adult bugs seem to hibernate there. Burning the stubble after harvest is also recommended. The information on *E. integriceps*, Put., in Turkey, is similar to that noticed in the following abstract.

SUREYA [M.]. **Turkey:** *Eurygaster integriceps.*—*Int. Bull. Plant Prot.*, iv, no. 1, p. 7. Rome, January 1930.

A station has been established at Adana to study the biology of the Pentatomid, *Eurygaster integriceps*, Put. The adult bugs hibernate on the slopes of the Taurus at altitudes between about 2,000 and 6,000 ft. In certain districts a Scelionid (*Teleas* sp.) destroys up to 95 per cent. of the eggs, and a Tachinid (*Phasia* sp.) attacks the larvae, but does not appear to destroy more than 10 per cent. Wheat cultivation should be restricted in areas of attack, preference being given to early varieties and to barley. *E. integriceps* occurs only in isolated cases in other parts of Turkey.

SCHANZE (K.). **Wie kann die Haftfähigkeit von Stäubemitteln geprüft werden?** [How can the Adhesiveness of Dust Insecticides be tested?]—*Der Deutsche Weinbau*, viii, pp. 419–420, 1929. (Abstract in *Zbl. Bakt.*, (2) lxxx, no. 15–22, p. 465. Jena, 24th March 1930.)

In methods of testing the adhesiveness of dusts by jarring them from a slanting plate [*R.A.E.*, A, xv, 646], there is a risk of separating the

actual insecticide from its carrier. The author's method is to dust the insecticide on to glass plates, then to steam and dry them, and finally to expose them for a rather long time to a powerful jet of water. Dusts with good adhesive qualities show a uniform coating on the glass plate.

STOLZE (K. V.). **Vorschläge zur Abänderung einfacher Spritz- und Staubgeräte für die Verwendung bei Hackfrüchten.** [Suggestions for the Modification of Spraying and Dusting Apparatus for Use with Root Crops.]—*NachrBl. deuts. PflSchDienst*, x, no. 3, pp. 17–18, 2 figs. Berlin, March 1930.

For spraying low-growing root-crops such as beet, the liquid from a knapsack container is led into a pipe branching into two tubes that project forwards. One is horizontal, with a nozzle pointing downward, and the other slants downward, with a nozzle close to the ground and pointing upward. The lower end of this tube is carried by a wheel pushed in front of the operator by means of the tube itself, which also lifts the leaves. The axle of the wheel is carried in a case that prevents the leaves from being entangled in it. Certain modifications of the "Puhuri" dusting apparatus [*R.A.E.*, A, xvi, 594] are also described.

MASI (L.). **Descrizione di un** *Tetrastichus* **parassita di** *Cassida vittata* **Villers (Hymen. Chalc.).** [Description of a *Tetrastichus* parasitising *C. vittata*.]—*Boll. Soc. ent. ital.*, lxii, no. 2, pp. 26–32, 1 fig. Genoa, 26th February 1930.

The Eulophid, *Tetrastichus bruzzonis*, sp. n., described from Verona, infests the larvae and pupae of *Cassida vittata*, Vill., which is a serious pest of sugar-beet in Italy. On an average, about five parasites appear to occur in each pupa. Records of *Tetrastichus* parasitising *Cassida* spp. in various parts of the world are reviewed.

CONTE (V.). **Esperimenti di lotta contro la mosca delle olive per mezzo di sostanze attrattive.** [Experiments in the Control of the Olive Fly by Means of attractive Substances.]—*Ann. R. Ist. sup. agrar. Portici*, (3) iii, pp. 308–320, 1 ref. Portici, 12th February 1930.

In the course of experiments at Portici against *Dacus oleae*, Gmel., the author tested the attractive power of various substances, of which the most effective was the liquid obtained from the olive after the oil has been separated. This liquid represents half the weight of the original olive, and when used fresh and undiluted was even more attractive than molasses. Losses due to evaporation should be replaced, not by water, but by the liquid itself, in no case diluted below half strength. This substance also attracted *Ceratitis* [*capitata*, Wied.] and wasps. Its composition and keeping power are being studied by Prof. Traetta, who has succeeded in keeping it in good condition for a year. In experiments with a 10 per cent. aqueous solution of beet molasses, it was found that the product from which the sugar had been removed was about three times as attractive as

the form containing sugar. Both the olive liquid and the molasses were used in baitpans hung up in the trees and sheltered from the wind. About one pan at least for every ten trees seemed satisfactory.

Ricchello (A.). **Esperimento d'attrazione d'insetti e specialmente di *Dacus oleae* eseguito nel 1929 nel comune di Ascea (Salerno).** [An Experiment made in 1929 in the Commune of Ascea in attracting Insects, especially *D. oleae*.]—*Ann. R. Ist. sup. agrar. Portici*, (3) iii, pp. 321–334. Portici, 12th February 1930.

In these experiments the baits were placed in pans of galvanised iron, each filled with nearly a pint of the liquid and hung in the crowns of large olive trees. The insects were counted daily or every two days, and the baits renewed every eight days or less. Vinegar in a 20 per cent. solution had a moderate attraction for *Dacus oleae*, Gmel., and a high one for Diptera in general, Microlepidoptera and Neuroptera. Olive liquid, at a strength of 10 per cent., had a fair degree of attraction, for Diptera and Microlepidoptera, and was negligible for other insects, but much higher concentrations are probably necessary [see preceding abstract]. Beet molasses in a 10 per cent. solution containing an arsenical was highly attractive to *D. oleae* only. At half this strength, beet molasses from which the sugar had been removed was very highly attractive to *D. oleae* and fairly so to Diptera in general. Sugar-cane molasses (10 per cent.) was very highly attractive to Diptera in general, highly attractive to Microlepidoptera, and fairly so to *D. oleae*.

The attraction of the various baits for *Dacus* decreases from the date when the pans are filled. This was especially the case with beet molasses, and further experiments showed that such solutions become valueless in 4–5 days in the case of the molasses without sugar and in even a shorter time for that containing sugar. The order of attractiveness of various concentrations of molasses containing sugar and poisoned with an arsenical was 20, 30, 10, 40 and 5 per cent. On the first day, the maximum effect was given by the 10 per cent. strength, but it would appear that the attractive power is retained better by the stronger concentrations.

Barbey (A.). **Description d'une nouvelle espèce de Pyralide (*Dioryctria aulloi*, n. sp.) nuisible à l'*Abies pinsapo* Boiss.**—*Bull. Soc. ent. Fr.*, 1930, no. 4, pp. 66–71, 2 pls., 3 refs. Paris, 1930.

In the course of a study carried out in April 1928 on insect pests damaging forests of *Abies pinsapo* in Andalusia, it was found that the unidentified moth previously recorded [*R.A.E.*, A, xviii, 179] is a new Pyralid, *Dioryctria aulloi*, sp. n. The larvae, pupae and adults are described, and the latter are compared with those of *D. mutatella*, Fuchs.

The moths emerge from overwintered pupae at the end of May or beginning of June and lay eggs at the base of newly formed buds. The larvae eat into the centre of the buds and bore in the twigs, the tunnels being sometimes as long as 3 ins. They feed for 5–6 months and migrate from twig to twig, the terminal ones being greatly preferred. Hibernation occurs in the pupal stage inside the tunnelled twigs.

THOMPSON (W. R.) & PARKER (H. L.). **The Morphology and Biology of *Eulimneria crassifemur*, an important Parasite of the European Corn Borer.**—*J. Agric. Res.*, xl, no. 4, pp. 321–345, 7 figs., 19 refs. Washington, D.C., 15th February 1930.

The Ichneumonid, *Eulimneria crassifemur*, Thoms., has been recorded as a parasite of Lepidoptera and sawflies in Europe, parasitism of *Pyrausta nubilalis*, Hb., sometimes reaching a maximum of 27 per cent. The authors, however, consider it possible that the parasite from *Pyrausta* is distinct. [It has been described as a new species, *E.* (*Limnerium*) *alkae*, by Ellinger & Sachtleben (*R.A.E.*, A, xvii, 215).] Its stages are described and its seasonal history in various regions is discussed. In studies of the bionomics [*cf.* xvi, 653; xvii, 216; xviii, 150], it was found that the adults, which may live as long as 111 days at a low temperature, will feed on honey or sweetened water but not on the body content of the host. Females may deposit as many as 300 eggs. These are laid in the body of young larvae, particularly those in the 3rd and 4th instars, and the parasite moves freely within the host, destroying it by absorbing the internal organs as the larva approaches maturity. The parasite emerges from the skin of the host and spins its cocoon in the borer tunnel, development proceeding slowly during hibernation. Temperature seems to be the most important climatic factor affecting the range of this Ichneumonid; other limiting factors are probably lack of synchronisation between host and parasite generations, the deposition of more than one egg in the same host, and cold, wet weather during the period of oviposition. Secondary parasites, among which are *Pezomachus* spp., *Dibrachys* sp. and *Melittobia acasta*, Wlk., have been reared from cocoons of *Eulimneria*, but are considered of negligible importance.

PETERSON (A.). **How many Species of *Trichogramma* occur in North America?**—*J. N. Y. Ent. Soc.*, xxxviii, no. 1, pp. 1–8, 2 pls., 3 refs. New York, N.Y., March 1930.

During recent years several investigators, including the author, have held the opinion that all species of *Trichogramma* described from North America belonged to one species. However, the author records observations that appear to prove the existence of at least two common species. For several years investigations were carried out with the so-called *Trichogramma minutum*, Riley, as an egg-parasite of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental peach moth) and *C. pomonella*, L. (codling moth). During the autumn of 1927, it was observed in New Jersey that the colour of the females, particularly on the thorax and abdomen, changed from light lemon-yellow to a dark metallic or dingy olivaceous brown. In the spring of 1928, the spring brood females and many of the first brood females were dark in colour, though the females of succeeding generations during the entire summer were light lemon-yellow. In the autumn of 1928, the females emerging late in October and after were again of a dark colour. This colour change also occurred at Columbus, Ohio, in the autumn of 1929 in individuals collected in Pennsylvania and Illinois. It was found that the change could be brought about by subjecting parasitised host eggs, particularly those collected or reared in the autumn, to certain conditions of temperature. Eggs parasitised by yellow females kept continuously

in a warm room (70° F.) produced yellow females for an indefinite period, whereas eggs parasitised by yellow females subjected to average daily temperatures of 55–62° F. or lower and also to some night temperatures of about 34° F. or lower, produced dark females. The colour of succeeding generations was alternated by subjecting them to the above conditions and differences in colour were produced in progeny of the same female by subjecting some of the eggs to room temperature and others to low temperatures. During the summer refrigeration may or may not produce a change in colour.

In May 1928, parasitised eggs of *C. molesta* collected in the field in New Jersey, produced females that closely resembled the dark-coloured females of the yellow species found in the autumn. The progeny of these females was kept separately and reared on eggs of *C. molesta*; dark females were produced in all succeeding generations during the summer of 1928. Only occasional collections of parasitised eggs from one orchard produced dark females in 1928; in other collections from many orchards the females were always yellow. In cross-breeding experiments with the two forms, no pairing was observed, and the progeny was male. It has been shown that unfertilised females produce males only. With males and females from the same source mating readily took place, and the progeny was two-thirds female. Moreover, it was observed that the life-cycle of the dark form was from a fraction of a day to several days longer than that of the light form, and from 25th May to the 15th October the dark females produced 10 generations, whereas the yellow ones produced eleven. The adults of the yellow form will crawl towards a strong light but seldom fly or jump any distance, whereas those of the dark summer form or species have a strong tendency to fly toward the light, especially if disturbed or touched. The author has up to the present been unable to find any morphological difference between the same sexes of the two forms. Enquiries elicited the fact that in most of the northern points of the United States where the dark females were being reared, the original stock had come from California or Louisiana. Native females of these northern localities were all yellow. If it is true that the species with yellow females in summer is more common in the north than that with dark ones, the advisability of using the southern form for liberation in the northern States may be questioned. In the original descriptions Riley states that adults of *T. minutum* are dark and that those of *T. pretiosum* may be distinguished by their uniform pale yellow colour. As his material was collected in autumn, it is possible that he may have been dealing with the dark-coloured adults of the yellow form, but the author suggests that these names be used provisionally to distinguish the two species discussed.

YOTHERS (M. A.). **Tree Hoppers and their Control in the Orchards of the Pacific Northwest.**—*Circ. U.S. Dept. Agric.*, no. 106, 13 pp., 9 figs., 3 refs. Washington, D.C., March 1930.

About 15 species of tree hoppers, a list of which is given, are more or less numerous in orchards of the Pacific Northwest, causing peculiar injury to the young wood of fruit trees by the slits they make for oviposition. As they feed in the nymphal stage almost exclusively on lucerne, though occasionally on sweet clover (*Melilotus*), grasses and other forage plants, their distribution generally coincides with the use

of lucerne as a cover crop in orchards. Of these species, *Stictocephala inermis*, F., *Ceresa bubalus*, F., and *C. basalis*, Wlk., are of economic importance and notes on their bionomics are given [*cf. R.A.E.*, A, xvi, 569]. The injury is due to the weakening effect of the oviposition wounds on the twigs rather than to the feeding of the adults, which causes comparatively little damage. Hatching of the eggs usually begins in early April and continues until early May, a temperature not below 50° F. being essential. The nymphs drop almost immediately to the ground or on whatever plants are present in the orchard, on which they feed. They require 60–80 days to mature, but are rarely observed, since they hide themselves at the base of the plants. The adults appear in late June or early July and are present until the end of September ; they sometimes fly, especially when disturbed, and in this way become disseminated over the orchard and from one lucerne field to another. Oviposition lasts from late July to mid-September, eggs being deposited in the slits one at a time until they are filled ; probably 100–200 eggs in all are laid by a female of any of the species. Hibernation occurs in the egg stage and may cover as much as nine months of the life-cycle.

Birds and toads are known to feed upon the tree hoppers both in their nymphal and adult stages. The nymphs of *S. inermis* are also destroyed by spiders, ants, Syrphid larvae, the Coccinellids, *Adalia bipunctata*, L., and *Hyperaspis quadrivittata*, Lec., and lacewings (*Hemerobius* and *Chrysopa*), and the eggs are parasitised by *Gonatocerus* sp. and *Tetrastichus* sp., and destroyed by Erythraeid mites of the genus *Achorolophus*, the latter attacking also the eggs of *Ceresa basalis*. The measures advocated are clean cultivation, pruning and spraying [*loc. cit.*], dormant sprays containing 4 per cent. or more of oil having been found to kill 70–100 per cent. of the eggs.

Miller (R. L.). **A Contribution to the Biology and Control of the Green Citrus Aphid,** *Aphis spiraecola* **Patch.**—*Bull. Florida Agric. Expt. Sta.*, no. 203, pp. 431–476, 18 figs., 33 refs. Gainesville, Fla., April 1929.

An account is given of the bionomics of *Aphis spiraecola*, Patch, in Florida [*R.A.E.*, A, xiv, 533 ; xvii, 277, etc.], including a list of the food-plants on which it occurs in this State, which the author's observations bring up to 30 species. The average length of life from August 1926 to August 1927 was 16·7 days for 198 females, of which 6·93 days was the average nymphal period. Reproduction was greatest at temperatures from 75 to 80° F. and averaged 29·11 young for 198 females. The maximum number produced in a day by one female was 16. Aphids feeding on hardening foliage or under crowded conditions produced many winged forms, but with plenty of tender growth no winged forms appeared, and life was twice as long under conditions of 100 per cent. humidity as when humidity was low. Notes are given on a number of predators of *A. spiraecola* ; in addition to those already listed are the Tenebrionid, *Epitragodes tomentosus*, Lec., the Hemerobiid, *Micromus posticus*, Wlk., the Reduviid, *Zelus bilobus*, Say, *Phymata erosa*, L., and the Anthocorid, *Triphleps insidiosus*, Say. The Braconid, *Lysiphlebus testaceipes*, Cress., is parasitic on the young Aphids, but apparently finds some difficulty in emerging from the body of the host. The latest control measures are discussed. Where

possible, it is well to dip the infested parts of the tree in a liquid insecticide. In spraying, if oil emulsions are used, it is very difficult to wet the foliage, and predators of the Aphids are frequently killed. Extracts of derris, 1 : 800 and 1 : 1000, killed 99 and 95 per cent. of the Aphids respectively after 36–48 hours, but had no more lasting or repellent action than had nicotine sulphate (1 : 800) with ½ to 1 per cent. soap solution, which also gave 99 per cent. mortality. A dust of 7½ lb. nicotine sulphate to 100 lb. lime (3 per cent. dust) killed 99·8 per cent. Pyrethrum extract (1 : 800) with 1 per cent. soap killed 98 per cent. Poorer results were obtained with lime-sulphur, snuff and fish-oil soap.

KNIGHT (H.), CHAMBERLIN (J. C.) & SAMUELS (C. D.). **On some limiting Factors in the Use of saturated Petroleum Oils as Insecticides on living Plants (Abstract).**—*Phytopathology*, xix, no. 12, p. 1136. Lancaster, Pa., December 1929.

Saturated petroleum oils of 75–100 seconds Saybolt have recently been used with success in the control of the red scale [*Chrysomphalus aurantii*, Mask.] and the black scale [*Saissetia oleae*, Bern.] on *Citrus* in California. Experiments to determine the effect of these oils on the plant showed that they initiated metabolic disturbances, which were reflected in decreased rates of transpiration, photosynthesis, downward carbohydrate translocation and in an increased rate of respiration. These effects, as well as the rate of recovery, are positively correlated with, and proportional to, the viscosity of the oil. Resumption of normal activity was found to be dependent on the elimination of the oil. Disappearance from the epidermis is due to intercellular absorption, the rate being a function of the viscosity of the oil and the epidermal and vascular morphology. Intracellular absorption then occurs, followed by translocation through the phloem and medullary rays to apparently permanent storage in cells of the pith and old xylem. Oil translocation is a long process and for the more viscuous types is probably never completed, thus serving to maintain a chronic condition of metabolic instability or abnormality. The employment of oils of 60 seconds viscosity or less for practical scale control is strongly indicated.

SHAPOVALOV (M.). **Tuber Transmission of Psyllid Yellows in California (Abstract).**—*Phytopathology*, xix, no. 12, p. 1140. Lancaster, Pa., December 1929.

Although *Paratrioza cockerelli*, Sulc (tomato psylla) has long been known to exist in California, Psyllid yellows on potatoes [*cf. R.A.E.*, A, xviii, 111] was not observed until the autumn of 1928. Of plants produced by tubers taken from infested fields, some were infected with yellows, some also showed symptoms of mosaic, and others were free from disease. Plants grown from tubers from different hills showed different stages of the disease. It was also observed in the spring of 1928 that fields planted with potatoes grown in infested areas exhibited a considerable amount of the disease in the absence of Psyllids. The symptoms, however, were very much more pronounced in the hot and dry interior sections than on the coast or in artificially shaded areas. These data indicate that in some localitities at least, Psyllid

yellows may be transmitted with the tubers, that the progeny may show various stages of the disease and that yellows and mosaic have distinct and specific effects when present in the same plant.

CARSNER (E.) & LACKEY (C. F.). **Mass Action in Relation to Infection with special Reference to Curly Top of Sugar Beets (Abstract).**—*Phytopathology*, xix, no. 12, p. 1137. Lancaster, Pa., December 1929.

That the quantity of the causal agent of curly-top is generally one of the determining factors in the infection of sugar-beet has been shown by varying the amount of inoculated virus (either by inoculations with contrasting numbers of leafhoppers [*Eutettix tenella*, Baker] or by unequal periods of exposure), by using plants differing in susceptibility, by studying the incubation of the virus in the insect, and by comparing the minimum infective doses of the virus in its virulent and attenuated conditions. The demonstration of "mass action" as a factor in curly-top infection supports the claim that the amount of damage is positively correlated with the number of leafhoppers present.

SWEZY (O.) & SEVERIN (H. H. P.). **A filterable Micro-organism from** *Eutettix tenellus* **and the Sugar Beet, both infected with Curly Top (Abstract).**—*Phytopathology*, xix, no. 12, p. 1143. Lancaster, Pa., December 1929.

Rickettsia-like micro-organisms were found to be common inhabitants of the intestinal tract of *Eutettix tenella*, Baker (beet leafhopper), the carrier of curly-top of sugar-beets. When the insects were macerated in a suitable culture medium and passed through fine (W) Berkefeld filters, similar organisms appeared by the second or third day in cultures made from the filtrate. No organisms have been found associated with this disease in the sugar-beet. When the juice from macerated beets was passed through the same type of filter, and cultures made from the filtrate, organisms were obtained similar to those in cultures from the insect. Slides were made in both cases from the filtrate immediately after passing the filter, but although these were fixed and stained by the methods used with slides from the cultures, they showed no visible organisms. Cultures made from non-infective beet leafhoppers and sugar-beets gave negative results in all cases, though the same culture media were used and identical processes followed throughout. It thus appears that the micro-organisms present in the infective leafhopper have a filtrable stage in their life-history, and cannot be obtained from cultures from non-infective insects or from healthy sugar-beets.

SEVERIN (H. H. P.). **Life-history of Beet Leafhopper,** *Eutettix tenellus* **(Baker) in California.**—*Univ. Calif. Publ. Ent.*, v, no. 4, pp. 37–88, 4 pls., 16 figs., 13 refs. Berkeley, Cal., 1930.

This is a detailed account of life-history studies of *Eutettix tenella*, Baker, carried out in the San Joaquin Valley, California, during 1919 and 1920, a summary of which has already been noticed [*R.A.E.*, A, x, 135]. The incubation period was erroneously stated in the abstract of this paper to vary from 11 to 15 days instead of from 11 to 55.

Additional information, taken from the author's subsequent work, is also incorporated [xiii, 48, 630 ; xiv, 450].

The following is taken from the author's summary : Three generations of the beet leafhoppers occur in the San Joaquin Valley. The progeny that develops from eggs deposited by the dark adults wintering on the plains and foothills represents the first or spring generation. In years with late spring rains, a partial second brood may develop during May and June on the plains and foothills. Large numbers of pale green adults usually congregate near the entrance of the Little Panoche Pass during April, and mating occurs at sunset. A second or summer generation develops in the cultivated areas ; congregations of enormous numbers of leafhoppers, mating and migrations occurred from 26th June to 26th July 1919. The autumn or third generation comprises the dark adults, most of which fly to the plains and foothills during the autumn and mate.

The minimum preoviposition period of first-brood adults was 3 days during July at a mean temperature of 80·3 F. The preoviposition period of the dark overwintering females varied from 3 to 4½ months ; hence no eggs were deposited during the autumn. The following percentages of dark females collected during the winter on the Coast Range had fully developed eggs in the ovaries : December, 4 ; January, 52–64 ; February, 86–99.

McColloch (J. W.) & Dean (G. A.). **Insects injurious to Corn.**—[*Rep.*] *Kansas State Bd. Agric.*, xviii, no. 191, reprint 41 pp., 37 figs. Topeka, Kans. [? 1930.]

This is a popular account of the bionomics and control of some twenty of the more important insect pests of maize in Kansas, and includes a key for their determination partly by their appearance and partly by the injury caused.

Ainslie (G. G.). **The Bluegrass Webworm.**—*Tech. Bull. U.S. Dept. Agric.*, no. 173, 25 pp., 4 figs., 21 refs. Washington, D.C., February 1930.

Crambus teterrellus, Zinck., is widely distributed in the eastern and south-eastern parts of the United States, but is most abundant in the limestone districts of Kentucky and Tennessee where Kentucky bluegrass (*Poa pratensis*) is dominant. The literature on this moth is very briefly reviewed, and its geographical distribution and economic importance are discussed. The damage it does seems to be limited entirely to more or less permanent grassland. In ordinary seasons it is a cause of serious depletion of pastures, and in dry years it may effect the complete destruction of turf. A detailed description of all stages is given. In the field, the generations cannot be distinctly separated ; from the time the first moths make their appearance in the spring they are usually continuously present in fluctuating numbers. Cage observations, carried out in 1915 and 1916, in central Tennessee, indicated that under ordinary conditions there are three broods each year, the egg stage lasting 5–7 days, the larval about 6 weeks and the pupal 5–15 days. The principal flights of the moths take place in May, July and September, and hibernation probably occurs in the larval stage only.

The larvae construct flimsy tubes of silk and earth particles, in which they remain during the day, emerging at night to feed on the leaves of grasses. The number of instars varies widely; the normal is eight, but as many as 20 have been observed, although there was no increase in size after the eighth instar. *Poa pratensis* is the preferred food-plant, but the larvae will feed on a variety of grasses, and have also been reared in the laboratory on wheat, rye and maize. The pupae are formed in loosely made cells constructed in the earth near the feeding burrow. The moths probably fly considerable distances, and are attracted to lights in large numbers. They oviposit by dropping their eggs at random, the average number produced being about 200–250, although one female laid 564. They usually live 7–10 days.

In one instance, a parasite, *Cymodusa mississippiensis*, Ashm., was reared by the author from a pupa of *Crambus*, and a larva of *Chauliognathus pennsylvanicus*, DeG., was observed feeding on a larva in the pupal case. Asilid flies (*Erax aestuans*, L.) were often seen to capture the moths. No practical method of controlling the larvae has been devised; poisoned bran bait gave no apparent results. Light traps, operated from dusk until midnight, would capture large numbers of female moths before they had oviposited.

Brisley (H. R.). **Occurrence of the Weevil** *Phyrdenus muriceus* **(Germ.) in Arizona.**—*Pan-Pacific Ent.*, vi, no. 3, pp. 127–128. San Francisco, Cal., January 1930.

A small local outbreak of *Phyrdenus muriceus*, Germ., occurred on egg-plants (*Solanum melongena*) in central Arizona during the summer of 1929. On 2nd August, 10 days after the first signs of infestation were observed, 25 per cent. of the plants showed definite wilting, and a month later 75 per cent. of the crop was rendered worthless. The infestation did not extend to tomatos, peppers [*Capsicum*] or *Datura meteloides*, growing close to the egg-plants, and no signs of infestation were found in a field of egg-plants about 100 yards distant. All stages of the weevil were present in the field on 2nd August. The eggs were found just below the surface of the ground near the stems. The principal damage was caused by the larvae, which were feeding on the roots to a depth of about 3 ins., and many were buried in the tissue of the underground stems. Pupae were found in earthen cells in the soil, and the adults were feeding on the stems at ground level. Probably the weevil has only one generation a year, since larvae, pupae and adults had all disappeared by 14th September.

Huckett (H. C.). **Dusting and Spraying Experiments with Potatoes on Long Island in 1927 and 1928.**—*Circ. N.Y. Agric. Expt. Sta.*, nos. 94 & 108, 10 & 12 pp., 2 pls., 4 figs. Geneva, N.Y., 1st January 1928 & 1st December 1928.

Spraying and dusting experiments on potatoes on Long Island have been continued [*R.A.E.* A, xvi, 204]. Those described from various districts in 1927 indicated that the fluctuations in superiority of the relative methods were chiefly due to local conditions. The outstanding result in 1928 was the consistently good protection afforded by Bordeaux mixture to the potato plant. Calcium arsenate was included in various sprays and dusts for the control of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] and flea-beetles. The use of special applications

of nicotine to control Aphids was not warranted by final results, as these insects were largely controlled by disease. Little, if any, advantage was gained by spraying with three nozzles per row instead of two.

Clark (E. P.). **Some Constituents of Derris and "Cube" Roots other than Rotenone.**—*Science*, lxxi, no. 1841, p. 396, 9 refs. New York, N.Y., 11th April 1930.

Since derris extracts may contain little or no rotenone, hitherto considered mainly responsible for their activity, and still make effective sprays, such preparations must contain other insecticidal properties. Recently, it has been shown that rotenone is present in large amounts in the Peruvian fish-poison "cube," which is the root of a plant stated in a footnote to have been recently identified as *Lonchocarpus nicou* [*cf.* *R.A.E.*, A, xviii, 357]. Extracts of this material are used to some extent as an insecticide in South America. Like derris root, "cube" yields a large quantity of non-crystallisable material, which remains in the rotenone mother liquors.

The non-crystalline extracts of derris and "cube" roots were studied to determine whether it was possible to obtain any material of definite composition that might be responsible for their physiological action upon fish or insects. When the non-crystalline material from derris root was dissolved in methyl or ethyl alcohol and suitably treated, a number of well-defined crystalline compounds were obtained, and three substances invariably predominated, a monohydroxy dimethoxy compound, $C_{23}H_{22}O_7$, melting at 218–220° C., a dimethoxy compound, $C_{23}H_{22}O_6$, melting at 171° C., both of which have been found in *Tephrosia* (*Cracca*) *toxicaria*, and a dimethoxy compound, $C_{23}H_{22}O_7$, possibly tephrosine, having a melting point of 198° C. When the rotenone mother liquors from "cube" root were submitted to the same treatment, they also yielded a crystalline mixture that proved to be either tephrosine and the compound melting at 171° found in derris and *Tephrosia*, or a mixture of these two compounds and a yellow crystalline dimethoxy compound with a melting point of 217° C. The yields of these products, both from derris and "cube" were remarkably high. Some samples of derris, which yielded less than 1 per cent. rotenone, gave 4–5·5 per cent. of the crude crystalline mixture, and the samples of "cube" yielded uniformly about 5·5 per cent. of a 2 : 1 mixture of tephrosine and the compound with a melting point of 171°. Further work is in progress upon these substances, but from the analytical data available it appears that all these compounds, including rotenone, are more or less related, and that this small group of chemical compounds may be responsible for the toxic properties of many widely distributed tropical fish-poisoning plants.

Marlatt (C. L.). **Report [1928-29] of the Chief of the Bureau of Entomology.**—39 pp. Washington, D.C., U.S. Dept. Agric., 1929.

The work of the United States Bureau of Entomology for the year 1928–29 is reviewed. Details are given of the investigations that are being carried out at the various experiment stations throughout the country. Much of the information has already been noticed from other sources.

Infestation by the plum curculio [*Conotrachelus nenuphar*, Hbst.] in the southern States was more serious during 1929 than at any time

since 1921. The lesser peach borer [*Aegeria pictipes*, G. & R.], which infests the trunks, larger limbs and crotches of peach trees, was prevalent in the orchards of the south-east. Paradichlorobenzene dissolved in cottonseed oil and applied with a brush to the infested areas killed the larvae rapidly without injury to the trees. Various experiments were carried out for the control of the pecan leaf case-bearer [? *Acrobasis palliolella*, Rag.], including dusting with aeroplanes [*cf.* *R.A.E.*, A, xviii, 66] and with ground machines. In the latter case, the best results were obtained with a dust consisting of 20 per cent. monohydrated copper sulphate, 10 per cent. lead arsenate and 70 per cent. hydrated lime, the factory-mixed dusts giving better control than the home-made ones. Good results were also obtained with Paris green, monohydrated copper sulphate and hydrated lime, and there was no injury to the foliage. In dusting experiments with calcium arsenate against the blueberry maggot [*Rhagoletis pomonella*, Walsh], one application resulted in a reduction of 62·69 per cent. in the number of larvae and two applications in a reduction of 89·6 per cent., when compared with the number in an untreated plot. Two applications by aeroplane at the rate of 6·61 lb. per acre reduced the infestation by 82·86 per cent. The cost greatly exceeded that of application by ground machines, but would be decreased if a larger area were treated. In connection with studies on the Japanese beetle [*Popillia japonica*, Newm.], it was found that the most satisfactory extracts of pyrethrum were obtained with pyridine, acetone, and isopropyl alcohol, and that derris is most effective when extracted with coal tar, naphtha or ethyl alcohol. Extracts of pyrethrum and derris are almost equally effective against *P. japonica*. On maize this pest was controlled by a dust composed of 9 parts hydrated lime and 1 part lead arsenate applied when the dew was still on the plants. In sections of eastern New England where sweet corn is grown, successful efforts have been made to lengthen the market period for the finer varieties of this vegetable by placing the ears in cold storage at freezing temperatures. It was found that when the maize was kept at or near 0° F., larvae of the European corn borer [*Pyrausta nubilalis*, Hb.] rapidly succumbed and that all were dead after 100 hours.

Trapping was only partly effective in controlling the dried fruit beetle [*Carpophilus hemipterus*, L.] in the fig orchards of central California owing to the greater attractiveness of ripening figs. The effectiveness of the bait, which consisted of a slowly fermenting mass of dried peaches, was increased by allowing it to become infested with larvae of *C. hemipterus*.

The possibility of the larvae of the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] surviving in *Citrus* juice was investigated at the Hawaiian laboratory. In one experiment the larvae were permitted to obtain air at the surface of the liquid and in the other this was prevented. Out of 1,447 larvae in the first experiment, none survived for more than 5 days. Out of 7,800 larvae in the second experiment, none survived for 72 hours. Studies on the susceptibility of Guatemalan avocados to attack by this fly showed that under cage conditions even the varieties with the thickest skins were infested, but in the field only 4 out of 1,269 fruits were proved to be naturally infested. At the insectary at Cuernavaca, Mexico, experiments were carried out in burying at different depths fruit infested with the larvae of fruit-flies. No adults of *Anastrepha striata*, Schiner, were able to emerge from a depth of more than 9 inches, whereas those of *A. ludens*, Lw., penetrated

through 18 inches of soil in several experiments It was found, however, that many more reached the surface when the fruit was buried in a shady situation than when it was in one exposed to the sun, a fact that probably accounts for the protection afforded by burial to a depth of 18 inches in the Rio Grande Valley. Observations on the biology of *A. ludens* showed that the pre-mating period of flies emerging in January averaged 25 days, and even males were alive after 5 months One female deposited 298 eggs during a period of 47 days. The adults were believed to feed on wild yeast-like organisms that occur on the outside of fruits and elsewhere. Cultures were therefore made of the yeast carried on the legs of the flies, and it was found that adults confined with this medium as their only source of food were still alive after 2½ months. In Florida such yeasts may form an important part of the diet of *Ceratitis capitata*, for flies of this species that were dying rapidly on sugar and water survived for long periods if given yeasts.

Where a crop is sufficiently valuable, good results can be obtained against wireworms by applying carbon bisulphide directly to the soil. Used at the rate of one fluid ounce in holes 4 ins. deep and 18 ins. apart, this fumigant will give a mortality approaching 100 per cent. The best results are obtained when the soil is uniform, of loose texture, with a moisture content of at least 10 per cent., and a temperature above 50° F. Further studies on the hibernating quarters of the strawberry weevil [*Anthonomus signatus*, Say] confirm results already noticed [*R.A.E.*, A, xvii, 274]. Careful burning of the narrow strip of infested woodland has in some cases reduced the numbers of the weevils to a point where direct control with poisoned dust was unnecessary, but this method is not advocated unless the fire can be confined to the area in which they are hibernating. The most important cultivated food-plants of *A. signatus* in North Carolina are strawberry, dewberry and blackberry, the more important wild ones being huckleberry, choke-berry, wild blackberry and dewberry. The survival of the larvae in cut buds is largely dependent on the stage of development of the buds and on moisture conditions ; their mortality is increased in the presence of excessive or insufficient moisture. Pyrethrum was found to be the only material that was toxic to the celery leaf-tyer [*Phlyctaenia rubigalis*, Gn.] and at the same time was not injurious to the foliage and did not leave an objectionable residue. In experiments undertaken with the object of lessening the cost of treatments, pyrethrum diluted with 50 per cent. lime or sulphur gave commercial control. The European earwig [*Forficula auricularia*, L.] is showing a tendency to become an agricultural pest and is spreading in rural areas. It has caused considerable damage in market gardens to cabbage and carrot seedlings and also feeds on celery, beans, potatoes and peas. It shelters in the heads of cabbage and lettuce and reduces the market value of these crops.

In connection with the control of the boll weevil [*Anthonomus grandis*, Boh.], a number of dusting machines have appeared on the market that expel a large quantity of dust and allow it to drift across the field, so that swaths of from 300 to 500 ft. can be treated. Careful tests of such dust clouds showed that a large quantity of the dust was wasted owing to an overdosage close to the machine and an irregular, inefficient dosage over the remainder of the area.

The loss in timber in southern Oregon and northern California due to the destruction of western yellow pine [*Pinus ponderosa*] by bark

beetles in 1928 was estimated at £250,000. It was found that *Thanasimus* (*Enoclerus*) *nigriventris*, Lec., the most important predator of the western pine beetle [*Dendroctonus brevicomis*, Lec.], often migrates in considerable numbers during the late larval period to the soil round the base of the tree, and large numbers of these Clerids can be preserved by preventing the burning of the stump and surrounding ground cover during control operations. Investigations in Minnesota and Wisconsin on the larch sawfly [*Lygaeonematus erichsoni*, Htg.] were continued, and it was concluded that this species, in which there is one male to 25 females, reproduces parthenogenetically, at least in part. It is much more susceptible to high temperatures than most insects, and the development of new growth at the time of oviposition has a distinct effect on the number of eggs deposited by each female. Encouraging results have been obtained in the work of introducing parasites for the control of the pine tip moth [*Rhyacionia frustrana bushnelli*, Busck] in Nebraska. The parasite, *Campoplex frustranae*, Cushman, has increased rapidly, and the rate of parasitism has been raised from about 20 to over 50 per cent. in localities where it has become established. Defects in chestnut timber were caused chiefly by *Melittomma sericeum*, Harris (timber worm), and those in white oak, and chestnut oak in particular, by *Corthylus columbianus*, Hopk. (pinhole borer). A characteristic stain accompanies injury by *C. columbianus*, increasing the area of the defect. Hibernating larvae of the satin moth [*Stilpnotia salicis*, L.] are affected, sometimes to a high degree, by fungi, and preliminary observations have shown that two species are concerned, *Beauveria globulifera* and *Isaria* sp. Experiments indicate that very young larvae of the gipsy moth [*Porthetria dispar*, L.] may be controlled by 3 lb. lead arsenate to 100 U.S. gals. water and older larvae by 4 lb. to 100 U.S. gals. provided that fish-oil is added at the rate of 4 oz. to each pound of poison. Promising results have also been obtained against *S. salicis*, using 5 lb. lead arsenate to 100 gals. water with the addition of 20 oz. fish-oil. This application, made during the first two weeks in June in New England, kills the half-grown larvae, and sufficient poison is retained by the foliage to control the newly-hatched larvae feeding in August and September.

Summary for 1929.—*Insect Pest Surv. Bull.*, ix, no. 10, pp. 383–403, 3 maps, multigraph. Washington, D.C., U.S. Dept. Agric., 1929.

This is a review of the situation with regard to the more important insect pests in the United States during 1929. Maps are given showing the present distribution of *Murgantia histrionica*, Hahn (harlequin bug), which did considerable damage in the Gulf Coast vegetable districts to a variety of cruciferous plants, *Epilachna corrupta*, Muls. (Mexican bean beetle), the winter survival of which in the southern States was the highest of any year on record, and *Tibicen* (*Tibicina*) *septemdecim*, L. (periodical cicada), brood iii of which appeared in a number of places in Iowa, Illinois, Missouri, Ohio and West Virginia. Severe infestations of woodland growth of poplar by *Stilpnotia salicis*, L. (satin moth) were observed for the first time in New England ; previously poplars and willows on estates and roadsides only had been attacked. *Malacosoma fragilis*, Stretch (tent caterpillar) was very abundant locally in California. *M. disstria*, Hb., and *M. pluvialis*, Dyar, were more numerous in western Washington than they had been at any time for several years,

defoliating fruit and other trees and shrubs. *Campoplex frustranae*, Cushman, which was introduced into the pine plantations in Nebraska in 1926 for the control of *Rhyacionia frustrana bushnelli*, Busck, has increased greatly in the last three years, the tip-moth infestation having been reduced from 92 to 33 per cent.

Lepidoptera observed for the first time in North America during the year were *Chrysoclista linneella*, Cl., on lime [*Tilia*] near New York City ; *Batodes angustiorana*, Haw., on yew in Victoria (British Columbia) ; *Cnephasia longana*, Haw., on strawberry fruit in Oregon ; and *Epinotia subviridis*, Heinr., which attacks cypress [*Cupressus*] and was described as new during the year, its distribution including British Columbia, Washington and California.

Insects observed in new localities included the apple maggot (*Rhagoletis pomonella*, Walsh), in Georgia ; *Pseudococcus boninsis*, Kuwana, in Mississippi ; and the filbert bud mite (*Eriophyes avellanae*, Nal.), in Connecticut. A very unusual infestation of strawberry crowns by the larvae of *Chrysobothris pubescens*, Fall, was reported from Washington. A similar instance occurred in Oregon in November 1928.

Yearbook of Agriculture 1928.—8vo, v+1145 pp., 250 figs., 30 maps. Washington, D.C., U.S. Dept. Agric., 1929.

This is the third in a series of yearbooks intended primarily to inform the practical farmer of the latest developments in agriculture. It contains numerous short articles dealing with the research and regulatory work of the Department of Agriculture and other recent work in agricultural science and practice. In his report (pp. 1–116) the Secretary of Agriculture deals with the progress of economic entomology, particularly in the control of the Japanese beetle [*Popillia japonica*, Newm.] and the insect pests of flour, in preventing the spread of the European corn-borer [*Pyrausta nubilalis*, Hb.] and the gipsy moth [*Porthetria dispar*, L.], and in the prediction of outbreaks of the sugar-beet leafhopper [*Eutettix tenella*, Baker]. He also discusses the maintenance of plant quarantines, the establishment of the Plant Quarantine and Control Administration, the apparent elimination of the Mexican fruit-worm [*Anastrepha ludens*, Lw.] from the lower Rio Grande Valley, and the measures taken for the control of the pink bollworm [*Platyedra gossypiella*, Saund.] in the main cotton belt in Texas.

Papers of entomological interest include the following : Airplane Dusting of Cotton Fields proves Effective, Economical, by B. R. Coad (pp. 117–120), which gives a brief history of this method of applying insecticides and explains its advantages ; Corn-borer Control by Mechanical Means is advanced a Stage, by R. B. Gray (pp. 222–224), in which a low-cutting attachment for maize binders is described ; Corn-borer Research lays Foundation for Control of the Pest, by W. R. Walton (pp. 224–227), which describes very briefly the research work that has been carried out in connection with the control of *Pyrausta nubilalis* since its discovery in 1917 ; Gipsy Moth and Brown-tail Moth [*Nygmia phaeorrhoea*, Don.] Campaign Status, by A. F. Burgess (pp. 342–345) ; Insect Control in National Parks is many-sided Problem, by H. E. Burke (pp. 382–385), in which the author points out that as the national park forests are not established for economic objects, but for the recreational, educational and historical value of the

trees, etc., more intensive and costly measures of control are both possible and justifiable; Insect Pest Survey assembles Data from all Parts of the Country, by J. A. Hyslop (pp. 385–388), which gives an account of the work of the Insect Pest Survey organisation; Japanese Beetle in narrow Range meets Variety of Conditions, by H. Fox (pp. 396–398), in which the author points out that even within the limits of a narrowly circumscribed area, environmental conditions may be encountered that are sufficiently diverse in character or intensity to have a marked influence on the rate of increase and of spread of *P. japonica*, and that the present areas of exceptionally heavy infestation within the heavily infested section no longer coincide with the original centre of maximum density; Japanese Beetle is controlled on some Trees by Spraying, by L. B. Smith (pp. 398–401), in which recommendations are given for spraying apples, peaches, grape-vines and ornamental shrubs with lead arsenate against *P. japonica*; Mexican Bean Beetle [*Epilachna corrupta*, Muls.] continues Destructive Spread in eastern U.S., by N. F. Howard (pp. 460–462); Red Clover's Hairiness in American Types is due to the Leaf Hopper, by A. J. Pieters (pp. 521–524), in which the author suggests that the hairiness of the American types of clover (which is descended from the English and Flemish varieties that have closely appressed hairs) is due to the gradual elimination of the smooth-haired plants by *Empoasca fabae*, Harr., which avoids the more hairy types; and Spray Residue Removal by Mechanical Methods is Extensively Tested, by L. A. Hawkins (pp. 553–555), which briefly discusses the use of hydrochloric acid and the importance of thorough rinsing in the removal of arsenical residue from fruit and vegetables.

MACKIE (D. B.). **The Campaign against the Mediterranean Fruit Fly and the present Situation in Florida.**—*Mon. Bull. Dept. Agric. California*, xix, no. 2, pp. 107–115. Sacramento, Cal., February 1930.

This is a detailed account dealing with the methods adopted against the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] in Florida and the measures employed in preventing its spread [*cf. R.A.E.*, A, xviii, 173, etc.]. A careful survey of all wild fruits in the areas surrounding every property in Florida at any time known to have been infested was conducted. Altogether nearly 800 square miles were surveyed, but no case of infestation has been found on any of the native fruiting plants in uncultivated land. Up to 1st December experiments have shown that oviposition and larval development can occur in over a hundred species of Florida fruits, and an even greater number are potential hosts.

MCDANIEL (E. I.). **The Strawberry Root-Weevil as a Pest in Conifer Nurseries.**—*Quart. Bull. Michigan Agric. Expt. Sta.*, xii, no. 3, pp. 102–105, 3 figs., 3 refs. East Lansing, Mich., February 1930.

During the spring of 1929, the strawberry root-weevil, *Otiorrhynchus* (*Brachyrrhinus*) *ovatus*, L., appeared as an important pest of young conifers in a large nursery in Michigan [*cf. R.A.E.*, A, xii, 98]. Arborvitae [*Thuja*] and various species of pine, spruce and larch were attacked by large numbers of larvae, which stripped the bark from the main roots an inch or so below the surface of the soil. The damage

was most severe on three-year-old seedlings and particularly on Norway spruce [*Picea excelsa*]. Older trees and species with a branching root system were better able to withstand injury. The first adult weevils emerged early in June. There is only one annual generation, though the adults live for a year or more, some ovipositing both in autumn and in spring.

The winter is passed in both larval and adult stages. It is suggested that two-year-old seedlings should be taken up in autumn and stored in cellars until the following spring, since the most dangerous period through which the seedling passes is the spring of the third year. The roots of trees sent out from infested nurseries can be cleared of the larvae by washing.

FRIEDERICHS (K.). **Die Grundfragen und Gesetzmässigkeiten der land- und forstwirtschaftlichen Zoologie insbesondere der Entomologie.** [The Basic Problems of, and Laws governing, Applied Agricultural and Forest Zoology, especially Entomology.]—Med. 8vo, Bd. I, xi+419 pp., 127 figs. ; Bd. II, vi+463 pp., 166 figs., 10 pp. refs. Berlin, P. Parey. Price, 2 vols., cloth, *M*. 64.

This work is an attempt to discuss from the ecological point of view all the main problems of economic zoology, and in particular of entomology. The study of pests is defined as economic ecology, the main aim of which is the investigation of the conditions of the fluctuations in their numbers, which are the cause of outbreaks.

The first volume deals with the more general ecological problems. The distribution of animals by habitats and methods for the quantitative studies of the population and of the environmental factors are described. Data on the influence of the various factors (temperature, light, humidity, food, etc.) on the life and development of animals are summarised. A special chapter is devoted to the ecology of animal communities and another to the animal population of the soil.

The second volume begins with a chapter on the history and present organisation of economic entomology in the United States (this section is a translation of a paper by L. O. Howard [*R.A.E.*, A, xv, 507]), Germany and Austria. A discussion on the course of invasions by an introduced pest, and on outbreaks of native pests occupies another chapter, all factors influencing the course of such outbreaks being summarised. The longest chapter of the volume deals fully with various methods of technical, cultural and biological control. Two chapters are devoted to useful animals, including the insects acting as pollenisers, the silkworm and the honey-bee.

Each volume has a separate subject index ; the first includes a list of the main ecological terms in German and in English, and the second is concluded by a bibliography of selected books and periodicals, while references to papers on special subjects are given in footnotes throughout the work.

MÉTALNIKOV (S.) & CHORINE (V.). **Etude sur l'immunité naturelle et acquise des** *Pyrausta nubilalis*.—*Ann. Inst. Pasteur*, xliv, no. 3, pp. 273–297, 1 pl., 1 fig., 71 refs. Paris, March 1930.

This account of experiments on the immunity of the larvae of *Pyrausta nubilalis*, Hb., from certain diseases is largely the same as

one already noticed [*R.A.E.*, A, xviii, 142], but the reactions concerned in the production of this immunity are discussed in somewhat greater detail.

Papers noticed by Title only.

Cathcart (C. S.) & Willis (R. L.). **Analyses of Materials sold as Insecticides and Fungicides during 1929.**—*Bull. New Jersey Agric. Expt. Sta.*, no. 485, 16 pp. New Brunswick, N.J., October 1929.

Robinson (R. H.) & Whitaker (C. F.). **The Chemical Composition of Insecticides and Fungicides.**—*Circ. Oregon Agric. Expt. Sta.*, no. 95, 19 pp. Corvallis, Ore., December 1929. [*Cf. R.A.E.*, A, xv, 184, etc.]

Barnes (J. W.) & Murray (C. W.). **Accuracy of the Gutzeit Method for the Determination of minute Quantities of Arsenic.**—*Indust. Engng. Chem.*, Anal. edn., ii, p. 29 (reprint 5 pp.). Easton, Pa., 15th January 1930.

Campbell (F. L.). **Methoden zum Studium der Giftigkeit magengiftiger Insektizide.** [Methods for the Study of Stomach-poison Insecticides.]—*Anz. Schädlingsk.*, v, no. 11, pp. 133–139, 10 figs., 6 refs. Berlin, 15th November 1929. [See *R.A.E.*, A, xiv, 281, 454; xviii, 311.]

Petersen (W.). **Die Blattminierer-Gattungen** *Lithocolletis* **und** *Nepticula* **(Lep.). Teil II:** *Nepticula* **Z.**—*Stettin. ent. Ztg.*, xci, no. 1, pp. 1–82, 3 pls., 16 figs., 41 refs. Stettin, 1930. [*Cf. R.A.E.*, A, xvi, 59.]

Kühn (A.) & Henke (K.). **Genetische und entwicklungs-physiologische Untersuchungen an der Mehlmotte** *Ephestia kühniella* **Zeller.** [Genetic and developmental-physiological Researches on the Meal Moth, *E. kühniella*.]—*Abh. Ges. Wiss. Göttingen*, mat.-phys. Kl., N.S., xv, 121 pp., 5 pls., 1929. (Abstract in *Zbl. Bakt.* (2) lxxx, no. 8–14, p. 320. Jena, 20th February 1930.)

Andersen (K. T.). **Der Einfluss der Temperatur und der Luftfeuchtigkeit auf die Dauer der Eizeit. I. Beitrag zu einer exakten Biologie des linierten Graurüsslers** (*Sitona lineata* **L.**). [The Influence of Temperature and Atmospheric Moisture on the Length of the Egg-stage. I. Contribution to an exact Biology of *Sitona lineata*.]—*Z. Morph. Oekol. Tiere*, xvii, no. 4, pp. 649–676, 4 figs., 30 refs. Berlin, 17th April 1930.

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Moulton (D.). **The Thysanoptera of Japan: New Species, Notes, and a List of all known Japanese Species.**—*Annot. zool. jap.*, xi, no. 4, pp. 287–337, 10 figs. Tokyo, 20th December 1928. [Recd. 1930.]

HAZELHOFF (E. H.). **Witteluis- en Topboorderbestrijding.** [Measures against *Oregma lanigera*, Zehnt., and *Scirpophaga intacta*, Sn., on Sugar-cane in Java.]—*Orgaan v.d. Suikertechnici*, Aug.–Sept. 1929, reprint 19 pp. Djokja, 1929. [*Cf. R.A.E.*, A, xvii, 630; xviii, 194.]

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MORDVILKO (A.). **Aphids of the Subtribe Hormaphidina.**—*C.R. Acad. Sci. U.R.S.S.*, 1930, pp. 168–172. Leningrad, 1930.

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PARKER (H. L.). **Sur le développement polyembryonnaire de** *Macrocentrus gifuensis* **Ashmead** [a Parasite of *Pyrausta nubilalis*, Hb.].—*C.R. Acad. Sci. Fr.*, cxc, no. 17, pp. 1022–1024, 7 figs., 1 ref. Paris, 1930.

DODD (A. P.). **A Revision of the Australian Teleasinae (Hymenoptera; Proctotrypoidea).**—*Proc. Linn. Soc. N.S.W.*, lv, pt. 2, pp. 41–91. Sydney, 15th May 1930.

PETCH (T.). **Yorkshire entomogenous Fungi.**—*Naturalist*, no. 880, pp. 201–203. London, May 1930.

BURNSIDE (C. E.). **Fungous Diseases of the Honeybee.**—*Tech. Bull. U.S. Dept. Agric.*, no. 149, 42 pp., 6 pls., 5 figs., 33 refs. Washington, D.C., January 1930.

PACKARD (C. M.) & THOMPSON (B. G.). **The Range Crane Flies** [*Tipula* spp.] **in California.**—*Dept. Circ. U.S. Dept. Agric.*, no. 172, 8 pp., 5 figs. Washington, D.C., October 1929. [Revision of previous Circular, *R.A.E.*, A, ix, 575.]

NEWCOMER (E. J.), YOTHERS (M. A.) & WHITCOMB (W. D.). **Control of the Codling Moth** [*Cydia* (*Carpocapsa*) *pomonella*, L.] **in the Pacific Northwest.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no 1326 revd., 25 pp., 19 figs. Washington, D.C., March 1929. [*Cf. R.A.E.*, A, xii, 247.]

WADE (J. S.). **List of entomological Publications of Personnel of Cereal and Forage Insect Investigations, U.S. Bureau of Entomology, 1904-1928, inclusive.**—46 pp. multigraph. [Washington, D.C., 1930.] U.S. Bur. Ent.

RIPLEY (L. B.) & HEPBURN (G. A.). **Olfactory and Visual Reactions of the Natal Fruit-fly,** [*Ceratitis*] *Pterandrus rosa* **(Ksh.), as applied to Control.**—*S. Afr. J. Sci.*, xxvi, pp. 449–458, 5 refs. Johannesburg, December 1929. [*Cf. R.A.E.*, A, xviii, 197.]

DAMPF (A.). **Bibliografía de los principales trabajos relativos al mosaico de la caña de azúcar que se han publicado a partir del descubrimiento de la enfermedad hasta el año de 1929.** [Bibliography of 436 Titles of the chief Papers on Sugar-cane Mosaic published since the Discovery of the Disease up to 1929.]—*Bol. mens. Defensa agric., Sec. Agric. Fom., México*, iii, no. 5–8, pp. 186–235. S. Jacinto, D.F., 1929.

STANILAND (L. N.) & UMPLEBY (E.). **The Control of the Red Bud Borer.**—*J. Minist. Agric.*, xxxvii, no. 1, pp. 59–63, 2 refs. London, April 1930.

As a result of serious damage to grafted buds on apple trees by the larvae of the Cecidomyiid, *Thomasiniana oculiperda*, Rübs. [*cf. R.A.E.*, A, iii, 74] at Long Ashton, experiments were carried out during the seasons 1926–28 to devise some means of control. In the first experiment, buds inserted and tied with raffia in the usual way were thoroughly coated with various substances. Lead arsenate paste did not protect the buds from attack, whereas palm oil, coconut oil and vaseline completely prevented infestation. The oils, however, seriously damaged the buds. Vaseline was then tested on a larger scale, newly budded roses being used as well as apple, since they are generally considered more susceptible to attack. The experiments showed that coating the buds with vaseline, immediately after tying, protects them from infestation, and does not affect adversely the percentage of successful budding. Though it is not certain that this percentage is increased, callus formation is greatly stimulated.

MENZEL (R.) & SCHELLENBERG (H.). **Die Milben- oder Kräuselkrankheit (Akarinose) der Reben.** [The Mite or Crinkle Disease (Acarinosis) of Vines.]—*Schweiz. Z. Obst- u. Weinb.*, xxxix, no. 7, pp. 172–176, 2 figs. Wädenswil, 29th March 1930.

The leaf-crinkle disease of grape-vines that results in a shortening of the internodes (" court-noué ") is due to two gall-mites, *Phyllocoptes vitis*, Nal., and *Epitrimerus vitis*, Nal., and is distinct from the leaf-pock disease produced by *Eriophyes vitis*, Pgst. In autumn, *Phyllocoptes* and *Epitrimerus* move to the point where the old wood begins in order to hibernate beneath the bark or the bud-scales. In spring they infest the buds and from there attack the young shoots. Eggs are laid from May to August. The mites are spread by active migration and by carriage by wind, man, animals, implements, etc. The best measure consists in painting or spraying with 3 per cent. potassium sulphide or 10–20 per cent. lime-sulphur before the buds swell. If this treatment has been neglected and leaf-crinkle appears, the shoots must be sprayed with lime-sulphur not above 2½ per cent. in strength ; or 1 per cent. lime-sulphur may be added to the usual fungicide sprays.

NEGI (P. S.), MISRA (M. P.) & GUPTA (S. N.). **Ants and the Lac Insect** (*Laccifer lacca*).—*J. Bombay Nat. Hist. Soc.*, xxxiv, no. 1, pp. 182–188, 3 pls. Bombay, 1st March 1930.

A brief account is given of the relations of various species of ants to *Laccifer lacca*, Kerr, including eight not previously associated with lac. They are not generally injurious to the lac insect, though some do destroy the larvae and males, but all are useful in that they remove the excreted honey-dew, which, when mixed with dust in the absence of rain, is likely to choke the respiratory organs of the Coccid and suffocate it. They also, especially *Camponotus compressus*, F., and *Solenopsis geminata*, F., feed on the larvae of predacious moths. The use of bands of cheap molasses is suggested to prevent ants having access to lac insects if they are suspected of being harmful, chiefly at the times of larval and male emergence.

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Headlee (T. J.). **Some Tendencies in modern Economic Entomological Research.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 28–38. Geneva, N.Y., February 1930.

The necessity for increased study of the bionomics of insect pests and their reaction to their physical and biological environment is pointed out, and recent developments in chemical, biological and physical methods of control are discussed. The manner in which economic entomologists may be aided in their task by the systematic entomologist, the insect physiologist, the biochemist, the biophysicist and the economist is indicated.

Farrar (M. D.) & Flint (W. P.). **Rearing Codling Moth Larvae throughout the Year** (*Carpocapsa pomonella*).—*J. Econ. Ent.*, xxiii, no. 1, pp. 41–44. Geneva, N.Y., February 1930.

The following is taken from the author's summary: A method is described whereby the larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., may be reared on a large scale for laboratory tests at any time of the year. Larvae are collected from orchard trees by the usual banding methods and transferred to Mason jars containing a number of corrugated paper strips ½ in. in width and 4–5 ins. in length. After the larvae have sought the shelter of these strips they are placed in refrigeration or kept out of doors at winter temperatures until spring, and then maintained at 50° F. until needed. To obtain newly-hatched larvae, the corrugated strips are placed in black emergence jars in an incubator and maintained at a temperature of 80–82° F. with a relative humidity of about 70°. The adults after emergence are transferred to special oviposition jars lined with wax paper, an apple being placed on the sand with which the bottom of the jars is covered. These jars are covered with cheese cloth and kept at the above temperature and humidity in a light approximating that of summer twilight.

The adults readily oviposit on the paper on the sides and bottoms of these jars, or on the apples placed in them, the average number laid by a single female being about 30. When the papers are well covered with eggs, they are cut into strips, placed in light-proof cardboard tubes, into the side of each of which a shell vial is inserted, and kept at ordinary room temperatures. The young larvae on hatching crawl into the vials and can then be transferred direct to the fruit.

Headlee (T. J.), Ginsburg (J. M.) & Filmer (R. S.). **Some Substitutes for Arsenic in Control of Codling Moth.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 45–53. Geneva, N.Y., February 1930.

An account is given of experiments carried out in New Jersey from 1927 to 1929 to test the comparative effectiveness in the control of the codling moth [*Cydia pomonella*, L.] of white oil impregnated with pyrethrum extract and nicotine tannate as substitutes for arsenicals. The results obtained in 1927 and 1928 indicated that when high viscosity oil is used at greater strength than 0·5 per cent., a certain amount of chlorosis and a considerable proportion of fruit drop are to be anticipated. In the 1929 experiments, considering picked fruit only and including the total yield of 8 selected trees, 80·8 per cent. of the fruit was free from all injury by *C. pomonella* on the pyrethrum block as compared with 59·9 per cent. from the arsenic-treated block. It

must be taken into consideration, however, that whereas only 3–4 applications of the standard arsenical spray are required, the oil sprays for the same period numbered 8, 3 against the first brood and 5 against the second, and when dealing with fruit picked in October, 9 applications may be needed. Although the cost is thus greater, better control and finer fruit are secured, and the necessity for the removal of spray residue is obviated. The oil-pyrethrum spray improved the vegetative character of the trees, and increased to a small extent the actual yield in fruit, but decreased the size of the fruit buds for the following year. Data obtained in 1929 from 5 selected trees in a row treated with nicotine tannate at the rate of 3 lb. tannic acid to 1 U.S. pt. 50 per cent. nicotine sulphate, and from 10 selected trees in the rows on either side that received standard arsenical sprays, showed 73·2 per cent. of the total fruit from the nicotine tannate treated row free from injury by *C. pomonella* as compared with 57·5 per cent. from the standard arsenical treated rows. It is as yet difficult and unsafe to foretell the effect of nicotine tannate on production over a period of years, but trees thus treated were shown to be as well protected against the Japanese beetle [*Popillia japonica*, Newm.] as those treated with standard arsenical sprays, and very largely protected against injury from late broods of leafhoppers.

SPULER (A.) & DEAN (F. P.). **New Combination Sprays for Codling Moth Control.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 53–61, 7 figs. Geneva, N.Y., February 1930.

This account of experiments in the addition of various materials to lead arsenate sprays for the control of *Cydia* (*Carpocapsa*) *pomonella*, L., which were carried out in 1928 and 1929, includes information already noticed from a report of the first year's results [*R.A.E.*, A, xviii, 273]. The addition of mineral oils of medium to high viscosity to lead arsenate has produced a combination having an ovicidal value of 80 to 95 per cent. and a larvicidal value much greater than that of lead arsenate alone. The addition of 1 qt. fish oil to 100 gals. spray containing lead arsenate, 1 lb. to 100 U.S. gals., is as effective as twice that amount of lead arsenate used alone. Nicotine-oil combinations have proved as effective as lead arsenate when applied as cover sprays for the first brood, and decidedly more effective if applied in second brood sprays. The combination of oil, 1 : 100, and nicotine sulphate ½ pt. to 100 gals. has given control of *C. pomonella* equal to that of lead arsenate 1 lb. to 50 U.S. gals. All combination sprays of mineral oil with lead arsenate are most effective if applied at periods of maximum egg-laying. In view of the removal of residues, combinations of mineral oil or fish oil with lead arsenate should be applied in first brood sprays and mineral oil-nicotine sulphate combinations in second brood sprays.

LEONARD (M. D.). **Further Experiments with Nicotine-Oil for the Control of the Codling Moth in the Pacific Northwest.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 61–75, 1 fig. Geneva, N.Y., February 1930.

An account is given of experiments carried out in 1929, in co-operation with several of the leading spray manufacturers, in the use of nicotine-oil sprays for the control of the codling moth [*Cydia pomonella*, L.] in the Pacific Northwest. The results obtained approximately substantiate those secured in 1927 and 1928 [*R.A.E.*, A, xvii, 369], the

tests in this case being carried out on a commercial scale rather than on the small test-plot basis. In most cases ½ pt. 40 per cent. nicotine sulphate to 100 gals. was employed. A consideration of the comparative results indicates that nicotine-oil combinations undoubtedly give better results when used only in the last 2 or 3 cover sprays than when used in all the cover sprays or in the early ones only. In most cases it is best to start the season with 1 or 2 applications of lead arsenate (2 lb. to 100 U.S. gals.) followed by 2 of lead arsenate-oil, completing the schedule with 2 or possibly 3 applications of nicotine-oil. This programme appears to be the most efficient in controlling the major pests of apples and also the most economical from the point of view of net returns to the grower.

NEISWANDER (R. B.) & STEARNS (L. A.). **Certain Factors influencing Oriental Fruit Moth Infestation.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 75–80, 5 diag. Geneva, N.Y., February 1930.

The following is the authors' abstract : Statistical interpretation of data accumulated in experimental orchard spraying in Ohio during 1929 for control of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental peach moth) indicates that peach tree vigour as evidenced by twig length and weight is distinctly correlated with the number and percentage of injured twigs ; furthermore, that a similar correlation exists between total fruit and the number and percentage of visibly injured fruit. Such influencing factors should be given adequate consideration in planning and in evaluating the results of control endeavours.

STEARNS (L. A.) & NEISWANDER (R. B.). **Hydrated Lime in Summer Sprays for the Control of the Oriental Fruit Moth. A Second Report.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 81–85, 1 fig., 1 ref. Geneva, N.Y., February 1930.

The results of laboratory tests and of both co-operative and experimental spraying, conducted in Ohio in 1929 for the control of *Cydia* (*Laspeyresia*) *molesta*, Busck, confirm the preliminary data obtained in 1928 [*R.A.E.*, A, xvii, 723], and indicate further that even greater effectiveness may be obtained with either 7 applications of hydrated lime increased throughout from 15 to 25 lb. to 50 U.S. gals. water, or 5 applications, omitting applications 1 and 5, at this increased rate, with the addition of an adequate sticker and spreader to the first three.

YETTER (W. P.). **Studies of Bait Traps for the Oriental Fruit Moth in Southern Indiana in 1929.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 85–89, 2 pls. Geneva, N.Y., February 1930.

An account is given of preliminary studies carried out in southern Indiana with baits against *Cydia* (*Laspeyresia*) *molesta*, Busck. Good results were secured with various aromatic chemicals used at the rate of 1 cc. to each U.S. quart jar containing solutions of either 10 per cent. black strap molasses to 90 per cent. water by volume or 1 U.S. qt. water to 3 oz. granulated sugar. Boiled peach juice made by boiling 20 lb. fresh peaches in 5 U.S. gals. water for an hour and used at the rate of 1 part to 3 parts of water by volume, with the addition of 3 oz. sugar also gave promising results. The use of a screen of ¼ in. mesh

over the mouth of the bait container apparently increases the efficiency of the traps. Glass containers were found to possess advantages over enamel or painted metal ones.

Davis (J. J.). [Introduction of *Macrocentrus ancylivora* into Indiana.] —*J. Econ. Ent.*, xxiii, no. 1, pp. 89–91. Geneva, N.Y., February 1930.

The following is taken from a discussion on the previous paper.

A brief account is given of the introduction of *Macrocentrus ancylivora*, Rohw., into Indiana against *Cydia molesta*, Busck. About 500 parasites bred from infested peach twigs collected in New Jersey in May were liberated in an orchard in the latter part of June, and weekly collections and records were made. By the end of the season, a maximum of 10·8 per cent. parasitism was obtained at a distance of 500 ft. north-east of the area of release; 55·9 per cent. 150 ft. north-east; 58·1 per cent. 400 ft. south-west; and 43·3 per cent. 1,000 ft. south-west. As the prevailing winds are from the south-west, the spread seems to be against the wind. T. J. Headlee, in the discussion that followed, stated that in infested areas, even where *M. ancylivora* is already present, artificial introduction has given a material increase in parasitism.

Haseman (L.). **Observations on a new Apple mining Caterpillar in Missouri.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 91–94, 1 pl. Geneva, N.Y., February 1930.

Injury to apples has been caused during the past two years in Central Missouri by the small larva of an unidentified species of *Carposina*. The larvae collected in 1928 closely resemble those abundant late in autumn on native species of *Crataegus* and recently identified as *Carposina* sp. Immature larvae from haws collected in the middle of November and transferred to apple continued to feed and caused the characteristic mine-like injury. Recent records indicate that the moth is quite widely distributed in apple-growing regions in Missouri and Kansas. An account is given of the varieties of apple attacked and of the nature and extent of injury caused. Infested fruit eventually rots, but the damage occurs after winter apples are stored and is rarely visible at the time of picking. Apples wrapped and stored about the middle of September, bearing no signs of attack, showed typical injury when examined 2 months later, and within ½ mile of the orchard a quantity of badly infested haws was collected.

The earliest evidence of the pest in 1929 was noted in late August, and half-grown larvae were collected from haws as late as 15th November. Fully-fed larvae emerged from stored apples as late as the first week in December. In the laboratory the last larvae emerged on 1st December from haws collected 15th November. The very young larvae became fully fed under laboratory conditions in 4–6 weeks. Although none of the other stages has been observed, it appears that the insect is single-brooded and that oviposition may take place from August until well into October. Brief descriptions of the larva and cocoon are given. It appears that the winter is passed in the larval stage and that transformation to the adult stage does not occur until the following autumn. If the pest becomes serious, it could probably be controlled by destroying all haws in the vicinity of apple orchards, thus depriving the larvae of a food-plant in which to over-winter.

Isely (D.). *Fidia longipes* **as a Grape Pest.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 95–97, 5 refs. Geneva, N.Y., February 1930.

Fidia longipes, Melsh., which has not hitherto been noted as a pest, is now known to be the most important insect enemy of grapes in Arkansas, where it occupied a position similar to that of *F. viticida*, Walsh, in the northern grape belts in 1928, and assumed still greater importance in 1929. The history and synonymy of this Eumolpid are briefly reviewed from the literature. *F. longipes* has been known to be fairly common in Arkansas since 1918, but occurred mainly on wild grape and was neither abundant nor widely distributed until 1928. The change in status of this beetle may perhaps be connected with the development of grape cultivation in Arkansas, where the area under grapes has increased from 540 acres in 1920 to 6,541 acres in 1925. *F. longipes* was found in about 15 per cent. of the vineyards visited in July 1929, and was in some cases numerous enough to cause serious foliage injury. All the infested vineyards were situated on well-drained hill land, no specimens of *F. longipes* being found in valleys or on poorly drained soil.

The adults feed on the upper surface of the foliage, leaving conspicuous chain-like marks, and the larvae attack the roots, but are not as abundant as *F. viticida* around the crown of the plant or around the larger roots. There is only one generation a year. The first adults emerged from the soil in 1929 on 13th June, or about a month after the blossoming of the grapes. This is relatively somewhat later than the date of emergence of *F. viticida* in the north. The beetles were abundant both in 1928 and 1929 throughout the latter part of June until mid-July, when their numbers began to decline, and were rare after 1st August. The shortest preoviposition period was 19 days. The eggs, which are deposited in batches of 20–60 under bark scales, hatch in 6–7 days (in July), and the larvae drop to the soil. The larvae form a hibernation cell below the frost line, where they remain until May. They feed for a short time in the spring, before forming their pupal cells.

Metcalf (C. L.) & Colby (A. S.). **The Meadow Grasshopper,** *Orchelimum vulgare* **Harris, a new Raspberry Pest.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 97–109, 1 pl., 8 refs. Geneva, N.Y., February 1930.

Orchelimum vulgare, Harr., which is recorded for the first time as a pest of raspberry, caused considerable damage in Illinois in 1928 and 1929 by ovipositing in raspberry canes adjoining crops of clover, cowpeas and lucerne. The history of the grasshopper is briefly reviewed, and a list of food-plants and its distribution in the United States are given. Severe injury was caused in 1928 to both red and black varieties of raspberry, about 70 per cent. of the canes being damaged. Most of the injured canes when left through the winter broke off at one of the oviposition scars and fell to the ground. Owing to stringent control measures adopted in 1928, injury was less severe in 1929, but the area of distribution had increased considerably. Oviposition takes place during late September and early October in southern Illinois, as many as 10–12 eggs being sometimes laid in a single puncture. The canes are commonly splintered by a row of from eight to several dozen scars, extending from 6 ins. to as much as 5 ft. Poorly splintered scars or those in particularly small canes are likely to be devoid of eggs or to contain very few. The hatching of nymphs of *O. vulgare* from

overwintering eggs in twigs allowed to remain until early spring under normal conditions out of doors, and subsequently kept at room temperature in the laboratory, occurred from 20th April to 10th May. Hatching occurs almost exclusively at night and appears to be stimulated by darkness and high humidity. Healthy young nymphs exhibit a rather definite positive phototropism combined with negative geotropism, which leads them towards the light where their food is most likely to be in a satisfactory condition. These conditions are reversed in the case of sickly individuals, so that they seek shelter in dark places and thus escape their natural enemies. Cannibalism occurs among the young nymphs, at least in captivity. They fed readily in the laboratory on the foliage of red clover and beans and the blossom buds of barberry, clover being the preferred food. The adults have been recorded as feeding on other insects, mainly Aphids, and on cranberry seeds. There is normally one generation a year, the winter being passed in the egg stage in the pith of plants. Nymphs hatch from the overwintering eggs in May and June and are common in July and August.

O. vulgare can only be satisfactorily controlled by cutting out infested wood as soon after oviposition as possible. As the fruit is only produced on the second year's growth of the canes and the eggs are invariably laid in young canes, such a wholesale destruction of fruiting wood results in a light crop of berries and involves considerable loss. The grasshoppers may also be caught by hand in large numbers in the early morning. The employment of either or both of these measures effected a considerable reduction in the infestation by 1929, but fresh outbreaks occurred in newly set plantations. Most of the infestations occurred in plantations surrounded by leguminous plants, the grasshoppers migrating to raspberry when these crops were cut. The close juxtaposition of leguminous plants and raspberry should therefore be avoided, and weeds should not be allowed to grow on the plantations during the summer. Clean cultivation, followed by a low-growing cover crop such as oats, planted in September, is recommended. Numerous specimens of a Proctotrupoid parasite, *Tumidiscapus flavus*, Gir., emerged from egg-bearing canes in the laboratory.

FELT (E. P.). **The Economic Importance of Shade Tree Insects.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 109–113. Geneva, N.Y., February 1930.

This is a brief review of some of the more important aspects of the injury caused by insects to shade trees in the United States. It is suggested that the mere reduction in the amount of wood produced in any one season is not the most serious part of the problem. Weakening of branches or leaves is usually evident first in the upper limbs and is followed by greater susceptibility to both insect attack and fungous infection. It is believed that a combination of these agencies, each of variable importance under different conditions, explains to a considerable degree the many dying tips generally attributed to other causes. More data are required as to the part played by insects in producing such conditions. The material value of shade trees should be taken into account in estimating the economic importance of the insects attacking them.

Smith (F. F.), Fisher (H. J.) & Guyton (T. L.). **A preliminary Report on the Control of the Pine Tip Moth,** *Rhyacionia frustrana* (**Comstock**).—*J. Econ. Ent.*, xxiii, no. 1, pp. 113–118, 2 refs. Geneva, N.Y., February 1930.

Rhyacionia frustrana, Comst., caused serious injury in pine nurseries in Pennsylvania in 1928. The species heavily infested included pitch pine (*Pinus rigida*), Austrian pine (*P. nigra* var. *austriaca*), Japanese pine (*P. densiflora*), Jack pine (*P. banksiana*), western yellow pine (*P. ponderosa*), mugho pine (*P. mughus*) and Scots pine (*P. sylvestris*). Japanese black pine (*P. thunbergi*) was less severely attacked, whereas white pine (*P. strobus*) and several species of spruce growing near by were not infested. On trees having large buds and heavy growth the injury is confined to the buds, but on species with small buds and weak growth the tips of the twigs are attacked as well, both buds and twigs being killed when infested. *R. frustrana* overwinters in the pupal stage in infested buds. There are two generations a year, the adults appearing with the warm weather in April or May, and those of the second generation during July and early August. Emergence in the second generation covers a period of about 3 weeks, whereas first generation moths are present from 4 to 7 weeks. The shorter period of emergence of the second generation and the exposed condition of the eggs indicated the use of an insecticide against the egg and early larval stages [*cf. R.A.E.*, A, xiii, 65]. The results are shown of a number of tests carried out with various materials in 1928 and 1929, some directed against all stages of the insect except the pupal, and others intended only as larvicides or ovicides. It is concluded from these tests that *R. frustrana* may be satisfactorily controlled by an insecticide applied at the proper time to the eggs and young larvae. The materials affording promising results were oils, such as 2 per cent. Volck or Sunoco.

Todd (C. J.) & Thomas (F. L.). **Notes on the Southwestern Corn Borer,** *Diatraea grandiosella* **Dyar.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 118–121, 2 refs. Geneva, N.Y., February 1930.

Diatraea grandiosella, Dyar, has been known to occur in the United States for more than 10 years, although it has frequently been recorded as *D. lineolata*, Wlk., a species now believed not to occur there. It was first recorded from Arizona, but caused considerable damage in Texas in 1922 [*R.A.E.*, A, xii, 166], where the semi-arid conditions have been the main factor in retarding its spread eastward, as no maize is grown except along the river valleys which run north and south. The distribution of *D. grandiosella* has extended northward in New Mexico and entered northwestern Texas, where it has been making a steady advance in all directions, facilitated by increased maize production. In October 1929 *D. grandiosella* was reported from Dalhart in the northwest corner of Texas, where the climatic conditions have evidently not been sufficiently severe for the borers to be killed by the present farm practices. The minimum temperature has been below zero, Fahrenheit, for each of the past 3 years, with $-9°$ F. as the minimum for 1928–29, and the normal December temperature is 32·2° F. The borer passed the winter in the larval stage in the tip of the maize root and in 1929 transformed into the pupal stage at the end of May, 20 pupae from overwintering larvae remaining in this stage for an

average of 14 days. On 27th May, 30 per cent. of the larvae had pupated, and by 25th June, 95–100 per cent. had become adults. One moth that emerged on 7th June, confined in a small cage, without food or opportunity to mate, laid 187 eggs on 9th June and died the following day. Like those laid on maize leaves in the field, the eggs were deposited singly. There are at least two, and probably three generations a year, the first attacking the maize when the plants are small, working into the crown and cutting off the bud leaves. Later generations bore into and tunnel the stalks, but do not enter the ears. The injury caused by the larvae varies according to the stage at which the maize is attacked and is worse in dry seasons. The last generation does not reduce the yield, as plants not previously attacked have had time to mature, but they are weakened and often break off. Greater injury occurs in those areas that have been longest infested. In one field in 1928, 100 per cent. of the stalks were observed to be infested and 48 per cent. were broken down. In 1929 the average loss estimated by a number of farmers was 40–60 per cent., and the difficulties of harvesting were greatly increased. A number of other forage crops were found to be injured when adjacent to fields of heavily infested maize. No general measures have yet been adopted for the control of this pest. Autumn ploughing of maize fields to expose the hibernating larvae is not regarded as a wise practice by farmers, as the resultant loss of soil by being blown away in the spring outweighs the possible advantage.

Hinds (W. E.) & Spencer (H.). **Progress in the Utilization of *Trichogramma minutum* in Cane Borer Control in Louisiana during 1929.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 121–127, 3 refs. Geneva, N.Y., February 1930.

Progress in breeding work and field colonisation of *Trichogramma minutum*, Riley, for the control of *Diatraea saccharalis*, F., in Louisiana in 1929 is briefly reviewed [*cf. R.A.E.*, A, xvi, 508; xvii, 720]. Improvements in the production of eggs of *Sitotroga cerealella*, Ol., have been in the direction of handling larger numbers of moths and the study of the influence on oviposition of starch and such factors as the position of the container and humidity. The containers at present in use are round battery jars 8 ins. in height and 6 ins. in diameter, covered with 20 mesh copper wire screening. Experiments under varying conditions with 50 such jars showed that the moths gave the highest yield when confined in large numbers (13,000 to a 3 qt. jar), and without the use of starch or other material to incite oviposition. Nearly twice as many eggs were deposited under these conditions as when the jars were inverted over starch. The accumulation of a large stock of eggs is secured by keeping them unparasitised in the refrigerator at a temperature ranging from 42 to 55° F. The eggs will keep under these conditions for as long as a month and give perfect results when exposed to parasites. Though the average production of eggs by a single female of *S. cerealella* has been found to be 30, freshly emerged and mated females may give twice that number. It therefore appears that miscellaneous collections of moths from breeding rooms may contain a large proportion of females that have previously deposited all or part of their eggs in the maize, the necessary high rate of infestation of which is thus helped to be maintained. Parasitised egg-

sheets are now kept in Petri dishes in the laboratory until the parasites emerge and mate, thus providing optimum conditions and protection against predators and unfavourable climatic factors. When the majority of the parasites appear to be ready, they are released a few at a time, so that they are distributed throughout the area to be colonised under conditions favourable for their immediate attack on the host eggs.

In 1929, 10,000,000 parasites were produced from moths reared from 100 bushels of maize, 1,500,000 of which were used for field colonisation between 28th May and 20th August. In a series of examinations made from 12th to 19th August, covering about 30 fields widely distributed in the sugar cane belt, eggs of *D. saccharalis* taken outside colonised areas showed an average of 27 per cent. parasitism, whereas the only field examined where parasitism was above 80 per cent. was a colonised one. A comparison of the occurrence of *T. minutum* in fields of various kinds of cane showed 90 per cent. of the eggs of *D. saccharalis* to be parasitised, between 10th and 13th September, which may be considered the average peak of parasitism. This high percentage was reached 4–6 weeks earlier in at least two of the colonised fields.

In a plantation on the western bank of the Mississippi, which normally yields 25 tons to the acre with a sucrose average of 13–14 per cent., infestation in 1927 was so severe that the final yield was reduced to 14·75 tons, and the sucrose average was only 8 per cent. The rapid effect of colonisation was shown in this area in 1929 when an equally severe infestation occurred in stubble cane, which usually yields a poorer crop than the plant cane infested in 1927, and the final yield averaged 19·12 tons to the acre with an average of 12·85 per cent. of sucrose. The distribution of parasites, which was largely responsible for the control of the borers, in this case amounted to a little more than 20,000 to the acre liberated between 28th May and 24th June. It is believed that this is the first case where a heavy initial borer infestation has been effectively checked by biological control methods in Louisiana, so that a profitable crop of cane was secured.

Burgess (A. F.). **Improvements in Spraying Equipment.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 132–136, 1 pl., 1 fig. Geneva, N.Y., February 1930.

The development of high-power sprayers is briefly reviewed, with particular reference to equipment that has been found satisfactory in work against the gipsy moth [*Porthetria dispar*, L.]. During the past year, an attempt has been made to improve the type of sprayer that takes its power direct from the shaft of the light motor truck on which it is mounted. By means of adding an additional shaft to the take-off, it has been possible to operate the machine up to 1,000 lb. working pressure with hose lines from 3,000 to 6,000 ft. in length. Owing to the light weight of the machine, it is possible to operate it in many places where a heavy machine could not be driven, and the take-off has been so arranged that by making one minor adjustment, trees can be satisfactorily sprayed when the truck is moving as well as when it is stationary. After the spraying season is over, by substituting a platform body, the truck can be used for other purposes.

Felt (E. P.) & Bromley (S. W.). **Shade Tree Insects in 1929.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 137–142. Geneva, N.Y., February 1930.

The following is taken from the authors' abstract of these brief notes relating to some of the more interesting insects that have come under consideration during the past year in the United States: *Nepticula sericopeza*, Zell. (Norway maple leaf stem miner) is somewhat generally distributed in south-eastern New York and south-western New England. Spraying with a nicotine molasses soap combination in May apparently gives excellent control. *Lachnus sabinae*, Gill. (red cedar aphis) provided an excellent outdoor demonstration of injuries earlier associated provisionally with this species. *Pachypsylla celtidis-mamma*, Riley, and *P. celtidis-gemma*, Riley, commonly produce galls on hackberry [*Celtis occidentalis*]. The former is readily controlled with a nicotine molasses spray applied about the middle of May, and the latter with the same materials applied about 10th June. This insecticide kills many adults and apparently destroys the eggs. *Andricus punctatus*, Bassett, *A. corniger*, O.S., and *A. claviger*, Ashm., which produce knotty galls on various species of oak, cause serious injury in some instances.

Myzocallis fumipennellus, Fitch (hickory leaf Aphid) is responsible for a very general discolouration of hickory leaves in the early autumn, most of the leaves being killed. *Agrilus anxius*, Gory (bronze birch borer) and *A. bilineatus*, Weber, which causes considerable damage to oaks, are generally distributed pests. Available data indicate that stimulation of growth in birches enables the trees in many cases to outgrow somewhat serious infestations. *Eriophyes avellanae*, Nal. (European bud mite) produces greatly enlarged buds on European filberts [*Corylus*] and has been associated with some severe injury. A paste of calcium cyanide and castor oil applied to areas infested by *Saperda vestita*, Say (linden borer) has given very encouraging results.

McConnell (H. S.). *Parlatoria oleae* **Colv., a Pest of Privet in Maryland.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 142–144, 1 pl. Geneva, N.Y., February 1930.

A scale found infesting twigs of California privet in Baltimore, Maryland, in the spring of 1927 was identified as *Parlatoria oleae*, Colv., which has been known at various times as *P. affinis*, Newst., and *P. calianthina*, Berl. & Leon. No previous reference has been found to the establishment of *P. oleae* in the United States, but two subsequent infestations have occurred, one of which was quite destructive. A light infestation of *Aspidiotus forbesi*, Johns., which was recorded for the first time on privet, was found in association with that of *P. oleae.*

Brief descriptions of both sexes of *P. oleae* and of the nature of the injury caused are given. The distribution of the scale, which probably originated in the Mediterranean region, is reviewed, and the more important food-plants are recorded. Hibernation occurs in the adult or almost full-grown stage, oviposition beginning with the approach of warm weather. The overwintering females lay an average of 60 eggs each. The first eggs were observed on 3rd May in 1928 and on 11th April in 1929. The incubation period varies from 15 to 30 days. There are two complete generations each season and possibly a partial third. The only natural enemies hitherto observed are a Hymenopterous

parasite, *Aspidiotiphagus citrinus*, Craw, and the larva of an undetermined Coccinellid, which feeds on the scales. Examination of twigs where the scales had not overlapped, after the application of a 3 per cent. oil emulsion in spring, before the leaves came out, showed only one live scale remaining to each 13 inches of twigs. Lime-sulphur is not a convenient insecticide for use against this scale in Baltimore on account of the proximity of hedges to houses.

BROWN (F. M.). **Bacterial Wilt Disease.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 145–146, 1 ref. Geneva, N.Y., February 1930.

A strain of *Staphylococcus flaccidifex*, which was obtained from an infected larva of *Danais archippus*,, F., in 1926, and several new strains obtained from *Pieris rapae*, L., *Colias* (*Eurymus*) *eurytheme*, Boisd., and other Lepidopterous larvae, were used in experiments carried out primarily to determine whether the organism was a general pathogen, or whether each strain was restricted to a single species or family of insects. All Lepidopterous larvae appeared to be equally affected by each strain. The disease proved to be highly successful in the laboratory both as regards fatality and contagion, but no real success was met with in efforts to infect healthy field colonies of *Malacosoma americana*, F.

CORY (E. N.), SANDERS (P. D.) & HENEREY (W. T.). **Some Phases of the Mexican Bean Beetle Campaign.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 146–149. Geneva, N.Y., February 1930.

A general account is given of the campaign carried out against the Mexican bean beetle [*Epilachna corrupta*, Muls.] in Maryland in 1929, showing the manner in which all branches of the community co-operated in the work. Details are given of the materials recommended, which included pyrethrum sprays for beans after the pods were formed. Applications were recommended to begin as soon as the beetles appeared and to be repeated at intervals of 8–10 days according to the weather, rate of growth of the plants and continuance of migration into the fields. Ploughing down vines immediately after the last picking was urged and generally practised. Tests of materials to determine whether they would render arsenicals less likely to injure the foliage showed an advantage from the mixture of copper sulphate, lead monoxide and zinc with calcium arsenate. Copper sulphate reduced the injury from arsenic both in dusts and sprays. Magnesium arsenate as a spray proved the most effective material for securing commercial control where a power sprayer could be used. The use of copper, arsenic and lime, 15 : 15 : 70, is recommended where dusting is advisable.

Early applications were necessary, some fields being dusted as early as 14th May. Emergence in cages occurred from 4th May until 1st July, the maximum being reached between 1st and 8th June, although elsewhere the first adult was collected on 30th March, the first eggs on 6th April and the first larvae on 27th April. The first adult of the first generation emerged on 27th June. Commercial dusting was begun on 29th May in the west, and in the east from 27th May to 12th June, according to the proximity of the fields to the south. Better results were secured with less cost in spraying twice a planting of

110 acres than in dusting twice a field of 80 acres. The average cost of spraying from 1 to 14 acres, using 3 lb. magnesium arsenate to 100 U.S. gals. water, was 4*s.* 9*d.* an acre. Cool nights and drought during August reduced the second generation by limiting egg-deposition, so that satisfactory crops were harvested although many late plantings were not treated. Good crops were also picked from very early untreated beans, but injury subsequently developed very rapidly and it was necessary to plough under the plants promptly in order to protect the later crops.

CHAPMAN (P. J.) & GOULD (G. E.). **Plowing as an Aid in Mexican Bean Beetle Control.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 149–154, 1 ref. Geneva, N.Y., February 1930.

An account is given of field trials in the control of the Mexican bean beetle [*Epilachna corrupta*, Muls.] in Virginia by means of ploughing, in continuation of burial tests begun in 1928 [*R.A.E.*, A, xvii, 619]. The results obtained indicate that this method may be effective, particularly against the immature stages of the beetle. In a comparative test of various cultural measures, no insects survived in the areas subjected to disking and ploughing, with or without the addition of harrowing, whereas 1·17 per cent. survived in the area ploughed only, and 1·53 per cent. in the area ploughed and harrowed. The ploughing depth was 8 inches.

Observations are recorded on the behaviour and fate of insects surviving ploughing, and on the longevity and food habits of beetles unfed after emergence. Although the larvae have little chance of surviving clean ploughing, those on the margins of the field may crawl as far as 12–15 ft. to another field in search of food. Adult beetles emerging on the surface, or reaching it after emerging underground, appear to require food before making prolonged flights. Studies to determine the length of time that beetles can survive without food after emergence indicate that in August, at an average temperature of 75°F., the majority die within 8 days and all within 10 days ; and in October, with an average temperature of 60° F., all die in 16 days. In an experiment in which marked beetles, unfed since emergence, were released 50 yds. from snap beans and only 6–8 ft. from soy beans, all appeared to migrate to the latter. Only a single marked individual was found on snap beans, 14 days after release. No beetles of a similar lot liberated 50 yds. south of snap beans, in a prevailing north-east wind, were located on them subsequently, but marked beetles were found on lucerne and soy beans 50 yds. to the south of the liberation point. The presence of weeds growing among severely infested crops may influence the number of individuals reaching maturity by providing shelter for pupation and in some cases by serving as food for the larvae in the absence of beans. Weeds on which the larvae have been found feeding include *Brassica nigra* and *Capsella bursa-pastoris*.

The necessity is urged for immediate ploughing under of bean plants at the completion of harvest in areas where *E. corrupta* occurs, special emphasis being placed on the reduction of the numbers of beetles entering hibernation. Lima beans, the bearing period of which admits of the development of three broods on a single planting, are a particular source of danger.

Hervey (G. E. R.). **The European Corn Borer with Respect to Sweet Corn in New York.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 154–157. Geneva, N.Y., February 1930.

A brief account is given of the results of two years' experiments in the control of the corn borer [*Pyrausta nubilalis*, Hb.] in New York State, where the infestation in 1929 was lighter than in 1928 [*R.A.E.*, A, xvii, 270], probably owing to late planting and a poor stand of maize. The average infestation in maize grown for canning, none of which was planted before the first week in June, was less than 10 per cent. A continuation of ploughing experiments begun in 1928 [*loc. cit.*] showed the average emergence of larvae buried during late autumn in gravel soil in plots 50 ft. square to be 32·56 per cent., and 64·44 per cent. when they were buried in spring. The emergence of moths from these plots was less than 1 per cent., but it was found to be slightly higher if the plots were not cultivated at intervals after the infested material was ploughed under.

Studies carried out to determine the fate of the larvae coming to the surface after being buried indicated that exposure was the chief factor in their mortality, but they are able to move considerable distances in search of shelter and may live for several days before succumbing. Many larvae are destroyed by ants and birds.

A comparative survey is given of the corn-borer situation in 1928 and 1929 in a small market garden where a special method of disposing of the maize stalks had been followed during the past few years. The stalks were cut as soon as the ears were picked off and put into the silo. The stubble was then disked thoroughly 3–4 times and the land sown to rye, which was ploughed under the following spring together with pieces of maize refuse left on the surface. The percentage of infestation fell from 18·2 to 9·56 per cent. in the ears, and from 23·5 to 11·92 per cent. in the stalks. Of the numerous materials tested as insecticides against *P. nubilalis*, the most promising appears to be calcium fluosilicate used as a spray, though slight injury is caused to the maize plants. White oil emulsion, which is more effective when combined with lead arsenate, gave a high rate of mortality against the egg masses when used at 3 per cent. Lead arsenate combined with fish-oil as an adhesive also gave a noticeable reduction. Various dusts were of little or no effect.

Cagle (L. R.). **The Plum Curculio Outbreak in the Charlottesville-Crozet Section of Virginia in 1929.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 157–162, 1 fig., 2 refs. Geneva, N.Y., February 1930.

Exceptionally heavy losses amounting to 5–50 per cent. were caused in a section of central Virginia to one variety of peach by an outbreak of curculio [*Conotrachelus nenuphar*, Hbst.], which was general on peaches throughout the State in 1929, though in some sections the loss did not exceed 5 per cent. Infestation by the oriental peach moth [*Cydia molesta*, Busck] on the same variety in this section ranged from less than 5 per cent. to 45 per cent. An investigation to determine the cause of the abnormally severe injury in this section showed that it was not due to a second brood of *C. nenuphar*. It is thought that the

omission of the petal-fall spray in the past probably played an important part in the outbreak, since infested peaches that drop early in the season may serve to carry over the infestation from year to year, although infestation of fruit at picking was prevented under normal conditions by the killing of overwintered adults by later sprays. During the past season heavy rainfall after application had rendered the sprays ineffective and allowed the adults to survive until the picking season. Cool, rainy weather from 12th April to 20th May probably caused delay in oviposition, so that the majority of the eggs were not deposited until the ripening period of the fruit.

Several, apparently heavy, early infestations were probably due to abnormally high temperatures which brought the adults out of hibernation during the blooming period, so that they were present in considerable numbers in the orchards when the peaches were large enough to furnish places for egg-deposition. It is suggested that a repetition of the outbreak may be prevented by including a petal-fall application in the spray schedule and by thorough cultivation.

Safro (V. I.). **A proposed basic Definition for Commercial Control.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 162–164, 1 ref. Geneva, N.Y., February 1930.

In view of the many disagreements as to the efficiency of various measures for minimising losses caused by insect pests that have arisen owing to lack of accuracy in the employment of the term "commercial control," the following definition is proposed: Commercial control is the measure of protection from insect attack that yields the maximum net return at minimum expense for the control operation. The term minimum expense is used to differentiate commercial control as here defined from that measure of control obtained by greater expenditures without a proportionate increase in the net value returned.

Filmer (R. S.). **Further Studies on the Problem of reducing the Nicotine Unit Charge of Nicotine.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 165–169, 1 ref. Geneva, N.Y., February 1930.

The following is taken from the author's summary of the results of experiments carried out in New Brunswick during May and June 1929, to confirm those secured by E. R. McGovran [*R.A.E.*, A, xviii, 278], which indicated that low concentrations of nicotine when used with 0·5 per cent. sodium or potassium oleate were toxic to Aphids. *Aphis spiraecola*, Patch, *A. rumicis*, L., *A. sorbi*, Kalt., and *Myzus cerasi*, F., were controlled in the laboratory with 0·5 per cent. sodium oleate plus 1–5,000 actual nicotine. In orchard tests *A. pomi*, DeG., and *A. sorbi* were controlled with 6 lb. commercial potassium oleate (40 per cent. H_2O) plus $\frac{1}{3}$ U.S. pt. 50 per cent. nicotine sulphate to 100 U.S. gals. This concentration is equivalent to 0·5 per cent. soap plus 1–4,800 actual nicotine. In the orchard experiments in which trees were sprayed while a fairly heavy coating of lead arsenate and sulphur

was present on the foliage, no foliage injury was noticeable 3 weeks after application of the spray. Experiments showed that repeated sprays of sodium and potassium oleate were not toxic to the foliage.

Huckett (H. C.). **Results from the Use of Nicotine in the Control of Sucking Insects on Potatoes on Long Island.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 169–174. Geneva, N.Y., February 1930.

The efficiency of nicotine mixtures in spray and dust form in the control of *Macrosiphum gei*, Koch (*Illinoia solanifolii*, Ashm.), *Myzus persicae*, Sulz., and *Empoasca fabae*, Harr. on potato, under the conditions prevailing on Long Island, is briefly discussed from a series of experiments carried out during 1926–1929 [*cf. R.A.E.*, A, xvi, 204]. The early variety of potato, which matures in July, largely escapes injury, but the Aphids usually become numerous shortly after the later variety, which matures in August, has come into full bloom during early July, 2½–3 months after planting. Hopperburn appears during mid-July for the first time, and the combined attack of Aphids and leafhoppers generally causes the destruction of much foliage by the first week in August where spraying has been carried out, and 2 weeks earlier where it has been discontinued. The nicotine spray, which consisted of 1 pt. 40 per cent. nicotine sulphate to 100 gals. Bordeaux mixture, was applied by means of a traction sprayer covering six rows and fitted with 2 nozzles for each row, directed forwards and downwards at a level with the top of the plants. A half-inch pipe was also attached to the sprayer 2 ft. in front of the nozzles to brush the vines over. Pressure was maintained at 200 lb. to the square inch, and the mixture was applied at the rate of 80–90 U.S. gals. to the acre. The dust, which consisted of 3 U.S. pts. 40 per cent. nicotine sulphate, 10 lb. dolomite and 50 lb. hydrated lime, was applied at the rate of 50 lb. to the acre at each application by means of a 4-row, self-mixing duster with distributors directed backwards in a horizontal plane at a height of 2 ft. The treatments with nicotine dust were made as an alternative or substitute for applications of copper-lime dust or spray. The climatic conditions during the growing seasons 1926–29 are briefly analysed in relation to the treatment and infestation in the experimental plots. The results of the various treatments were recorded, once immediately following each special application for Aphids to determine the degree of reduction in numbers secured, again at the close of the applications to compare the condition of the foliage on the various plots; and finally at digging to compare the yield of the tubers. A comparison of the increase or reduction in the number of Aphids on the foliage emphasised the superiority and consistency of nicotine treatment in dust form, and plots dusted with nicotine gave superior results on the average in respect of the condition of the foliage in 3 out of the 4 seasons. In 1928, when late blight was prevalent, the use of copper with the nicotine spray had a decided advantage over treatment with nicotine dust, to which copper could not be added owing to incompatibility. As regards the yield of tubers, plots receiving treatment with nicotine dust, whether previously sprayed or dusted, gave much greater increases in 9 out of 10 instances than those receiving any other treatments applied in 1927 and 1929 and in the later planted series in 1928. On the other hand, in 1926 and in the early planted series in 1928, there was comparatively little difference between treated and

untreated plots. The superior results achieved with dust were largely due to the greater simplicity of application as compared with the difficulties encountered in spraying.

SCHOENE (W. J.). **Leafhopper Association on Apple.**—*J. Econ. Ent.* xxiii, no. 1, pp. 177–181, 2 charts, 4 refs. Geneva, N.Y., February 1930.

A brief report is given on life-history studies and field observations of leafhoppers in apple orchards in Virginia, where serious injury has occurred. *Empoasca fabae*, Harr., which is primarily a pest of nursery stock, confines its attacks almost entirely to the tender foliage, which is badly curled, and rarely attacks older leaves. This species hibernates in the adult stage. *E. maligna*, Walsh, was sufficiently numerous to cause injury in 1927, when the adults were present from 1st June to 10th July. Both adults and nymphs feed on the older foliage. Adults enclosed in large lantern globes over apple during the summer of 1928 deposited eggs which hatched in the spring of 1929, the insects reaching maturity in June. There appears to be only one brood. *Typhlocyba pomaria*, McAtee, which is the most injurious leafhopper in Virginia, hibernates in the egg stage and has two broods annually. The first brood is present in maximum numbers during the first two weeks in June, but the numbers are reduced by a Dryinid parasite. In 1927 parasitism was as high as 70 per cent. in some cases. The adults of the second brood appear about 1st September and are very numerous during that month. This species attacks the older foliage. It appears that some adults continue to feed and deposit eggs until 1st November. The results of life-history studies of *Erythroneura harti*, Gill., *E. obliqua*, Say, and *E. dorsalis*, Gill., which are shown in chart form, indicate that a period of 25–30 days is required for the eggs to hatch and a similar period for the nymphs to mature. The overwintering adults continue to oviposit over a period as long as 2 months, and nymphs therefore continue to hatch for an equally long period. First brood adults of all 3 species matured about 1st July in 1929. The first adults to reach maturity deposited eggs, but those developing later did not oviposit during 1929. *E. dorsalis* and *E. obliqua* feed and deposit eggs readily on small apple trees growing in the insectary, the tough leathery foliage of which appears to suit them.

PARROTT (P. J.) & GLASGOW (H.). **The Rosy Aphid in Relation to Spray Practices.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 182–184. Geneva, N.Y., February 1930.

A brief summary is given of experiments carried out with lime-sulphur, Bordeaux mixture and oil emulsions containing nicotine extracts against *Anuraphis roseus*, Baker, which is one of the major pests of apple in New York, where injury varying from 11·20 per cent. to 47·40 per cent. has been observed over the period 1921–1929. The different sprays were applied under conditions as nearly comparable as possible at the rate of 10–12 U.S. gals. per tree, treatments being timed with reference to the different stages of blossom and bud development. The percentage of injured apples at the time of picking was 51·65 on 15 unsprayed trees. In two lots of 8 trees, each sprayed with lime-sulphur (1–40) with 1 pt. nicotine sulphate to 100 gals. the corresponding percentages were 0·28 and 3·06. Of four types

of oil sprays tested, only one commercial preparation approached the degree of protection obtained with lime-sulphur and nicotine sulphate, the injured apples representing 7·49 per cent. of the crop. With combinations of lime-sulphur and nicotine sulphate, insecticidal efficiency varied with the nicotine content. At the rate of ½ pt. nicotine sulphate to 100 gals., the percentage of infested apples was 7·38, and at half this rate it was 12·46. No appreciable differences in insecticidal efficiency were noted between nicotine sulphate and free nicotine, using as the carrier a lubricating oil emulsion (3 per cent. oil) containing gum arabic as the emulsifier. The percentage of infested apples on trees sprayed with nicotine sulphate was 7·02; with free nicotine 6·21. Nicotine sulphate in lime-sulphur proved consistently more effective than Bordeaux mixture containing the same amount of nicotine sulphate. Certain oil sprays with low toxicity to Aphids showed improvement in insecticidal efficiency upon the addition of nicotine sulphate. The percentage of injured apples on trees sprayed with paraffin oil (4 per cent.) was 43·60, and with paraffin oil (3 per cent.) containing 1 pt. nicotine sulphate it was 7·02.

To secure maximum control of *A. roseus*, the spray should be applied during the period following the separation of the tips of the leaves of the developing fruit buds and before the pink colour shows appreciably in the central buds of the blossom clusters. Spraying in the late pink or calyx period has consistently given inferior control.

HARMAN (S. W.). **The Efficiency of various Insecticides in controlling the Bud Moth.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 184–187, 1 ref. Geneva, N.Y., February 1930.

An account is given of two series of experiments in the control of *Eucosma* (*Spilonota*) *ocellana*, Schiff., a pest of major importance in certain sections of western New York [*R.A.E.*, A, xvii, 723], one directed against the larvae when emerging from hibernation in early spring and the other against the young larvae in the summer. The life-history is described in detail [*cf. loc. cit.*].

Probably owing to abnormal weather conditions, the period during which the larvae were issuing from their winter quarters was extended in the spring of 1929 over a period of 4 weeks, commencing when the green tips on the first buds were showing and continuing up to the time of the pink stage of the apple blossom buds. In heavily infested orchards nicotine was the only material to which the overwintering larvae were susceptible. In such cases a dosage of 1 qt. of 40 per cent. nicotine sulphate was required, the usual dose of 1 pt. being inadequate. When used with linseed oil or fish oil (1 qt. in 100 gals.) or with lubricating oil emulsions, the effectiveness of the nicotine was apparently increased. The larvae appeared susceptible to treatment with nicotine solution just previous to emerging and also after emergence if coated with spray.

The eggs of *E. ocellana* began hatching by the middle of July in 1929, and the maximum was reached about the last week of that month. A second cover spray was therefore applied at the beginning of the egg-hatching period, and a third after the majority of the larvae had hatched. All spraying was done from the ground by directing the nozzle upward and outward from the centre of the tree, to coat the lower leaf surfaces. Lead arsenate, which was apparently of little value early in the season, was effective, when used at the rate of 3 lb. to

100 U.S. gals. either alone or with the addition of 1 pt. nicotine sulphate during the egg-hatching period. Materials used in early season treatments which gave little or no promise in the control of the larvae in heavily infested plantings included: lime-sulphur, Bordeaux mixture, calcium arsenate, Paris green, lubricating oil emulsions alone or saturated with paradichlorobenzene, and miscible oil.

HOERNER (J. L.). **Penetrol as an Activator for Nicotine.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 174–177, 1 pl., 2 refs. Geneva, N.Y., February 1930.

A thorough study of penetrol, a sulphonated oxidation product of petroleum, has shown it to possess definite activation properties when used with nicotine [*R.A.E.*, A, xvii, 715]. The disadvantages of soap as an activator for nicotine are discussed, and a comparative test of the relative compatibility of penetrol and soap in water of varying degrees of hardness is described. An analysis is given of the waters used in in the tests, which were prepared in the laboratory. The soap used was commercial potassium fish-oil soap containing 30 per cent. water, and it was dissolved directly in the final volume of hot wate.. The penetrol was first mixed with 3 times its own volume of water before the final dilution was made. After they had been allowed to stand for 8 hours, no marked change was observed in any of the penetrol samples, whereas the soap showed a variation from a clear solution in distilled water to a heavy curdy precipitate in the hard water.

In tests in which Paris green, calcium arsenate and lead arsenate were used with penetrol diluted at the rate of 0·5 per cent., no scorching of foliage occurred either in the laboratory or in the field. A number of different tests have shown penetrol to be compatible with Bordeaux mixture as a substitute for soap, which clogs the nozzle and counteracts the necessary spreading properties of the spray. A representative table is given to show the results obtained by spraying with penetrol-nicotine and soap-nicotine combinations on *Macrosiphum* sp. on *Helenium* sp. (temperature 75° F.; relative humidity 51). Data given to indicate typical activation results against *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., *Myzus persicae*, Sulz., and *Aphis spiraecola*, Patch, show that the use of penetrol as an activator for nicotine gives consistently better results than potassium fish-oil soap on all the species tested. The dilutions used were penetrol or fish-oil soap 1–400, nicotine (50 per cent.), 1–10,000.

PEAIRS (L. M.) & GOULD (E.). **Notes on the Pistol Case-bearer.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 188–190. Geneva, N.Y., February 1930.

An unusual outbreak of the pistol case-bearer [*Coleophora malivorella*, Riley] has occurred on apple during the past few seasons in the north-east of West Virginia. Attempts to control the insects by regular spray treatments in 1928 and 1929 failed to reduce their numbers sufficiently to prevent serious damage. The treatments tried included

excessive strengths of lime-sulphur, different kinds of miscible oils, large quantities of lead arsenate and nicotine sulphate with and without penetrol. As the resistance of *C. malivorella* appeared to be due to its protective case, which is virtually impenetrable by any of the contact sprays, and to its habit of feeding mainly within the buds of apple in spring, it was hoped to control it by spraying immediately after the hatching period and before the young larvae had constructed their cases.

Life-history observations indicated that the larvae continue to feed until about the middle of May. The first pupae were found on 22nd May, and emergence lasted from 8th June till 3rd July. The majority of the moths appeared between 19th and 21st June, and oviposition lasted 27 days from 9th June, the peak of oviposition occurring about 21st June. The first larva was observed on 20th June, and the majority of the eggs, nearly all of which were laid on the upper surface of the leaves, had hatched by 14th July. The young larva, on hatching, feeds for about 3 days within the leaf, emerging through a small hole on the underside with its first protective cocoon already partly formed. Little feeding is done on the surface during the late summer, and by 5th October the cocoon is completed, being attached to a twig.

On the basis of these observations, tests were concentrated on contact insecticides, the most successful of which was found to be nicotine sulphate, 1–800, with the addition of 0·5 per cent. penetrol [see preceding paper], which gave about 100 per cent. control. An emergency application made between 17th and 27th July at the rate of 15 U.S. gals. to a tree gave an average kill, based on counts of insects after treatment, of 78·92 per cent.

Hartzell (F. Z.). **Toxicity of Sprays and Spray Ingredients on Pear Psylla Nymphs.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 190–197, 1 ref. Geneva, N.Y., February 1930.

The following is the author's abstract : Experiments were conducted on the nymphs of *Psylla pyricola*, Först., (pear psylla) with various combinations of the following ingredients : Bordeaux (2–40–100), nicotine sulphate, free nicotine, Derrisol (1–533), M-P insecticide (pyrethrum extract 1–560), white petroleum oils, pine oil, Hardwood neutral oil and penetrol. The trials were made in commercial orchards, using a large spray rig. All the ingredients showed toxicity towards nymphs of *P. pyricola* at the various strengths used. The percentage of dead nymphs varied directly with the proportion of white oil, but nicotine (1–3,200) showed a certain toxicity which appears to be but slightly increased by larger dosages. The several ingredients when mixed seemed to increase the destructiveness of the resultant mixture by an amount equal to the sum of the specific toxicities of the components. It is indicated that the nicotine content of sprays directed against the nymphs of *P. pyricola* can be considerably reduced provided that other toxic materials are added which do not react unfavourably with the nicotine. The percentage of white oil can be reduced in the spray mixtures if nicotine in pine oil or Hardwood neutral oil be added. Pine oil (1 per cent.) and Hardwood neutral oil (1 per cent.) show promise of reducing materially the nicotine content of the regular

spray. Penetrol (0·5 per cent.) in Bordeaux with reduced nicotine dosage was tested the most extensively and appears to be innocuous to foliage during the spring application if normal temperatures prevail.

Chapman (P. J.) & Gould (G. E.). **Some Notes on dusting Cucumbers.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 197–202, 2 refs. Geneva, N.Y., February 1930.

Preliminary tests were made in 1929 with dusts, which included hydrated lime, gypsum, and these two materials with calcium arsenate, sodium fluosilicate, and calcium fluosilicate, to determine their efficiency in protecting cucumbers from the early attack of *Diabrotica vittata*, F., and *D. duodecimpunctata*, F., and to estimate the extent to which these materials inhibited plant growth. The application rate for the hydrated lime, copper sulphate and lime and sodium fluosilicate was approximately 30 lb. per acre, that for calcium fluosilicate 45 lb., and for gypsum 100 lb., although the wastage in the application of gypsum with the dusting machine is large. Plants treated when moist with dew were of a smaller average size than those treated when dry, regardless of what dust was used. The differences ranged from sodium fluosilicate, which killed plants in the wet series outright, to gypsum and calcium fluosilicate, where the difference was insignificant.

As damage from cucumber beetle was unimportant in 1929, the differences in size among the treated plants may be considered to be due primarily to the reaction between plants and dust rather than to the degree of protection these materials afforded against insect attack. Plants treated with gypsum, either wet or dry, were of a smaller average size than plants receiving hydrated lime while dry. More material obviously adhered to plants dusted while wet, and apart from cases where toxic material was added to the solution, the generally smaller size of the wet plants may be due simply to the degree to which metabolic activities were interfered with, a condition that would normally result from the presence of any finely divided foreign matter.

Garman (P.). **Oriental Peach Moth Control Studies in 1929.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 203–205, Geneva, N.Y., February 1930.

In field experiments in the control of *Cydia* (*Laspeyresia*) *molesta*, Busck, in Connecticut in 1929, applications of talc dust gave no control, and only slight reductions in infestation were secured by the use of lime or oil combinations. Infestation among trees sprayed with white oil emulsion (·83 per cent. oil content, viscosity 108 Saybolt), 1 : 100, at the rate of 8 gals. to a tree, amounted to 7 per cent., whereas the control trees showed an infestation of 20 per cent. No injury was seen to any of the trees, though the last oil spray, applied on 30th August, caused some spotting of fruit, and residues from whitewash and talc remained. Trees sprayed with lime were noticeably free from spray injury. In ovicide experiments carried out in the laboratory to test the results secured in the field with various oils, pure 1 per cent. white oil emulsified with skim milk gave excellent results, and those obtained with pine oil combinations were also good. The increase from additions of pyrethrum soap and nicotine over the same oil and the same emulsifier at the same dilution seems to be slight.

Lipp (J. W.). **Experiments against wintering Larvae of the Oriental Peach Moth,** *Laspeyresia molesta* **Busck.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 205–208, 3 refs. Geneva, N.Y., February 1930.

Tests were conducted during the dormant seasons of 1927–28 and 1928–29 against the hibernating larvae of *Cydia* (*Laspeyresia*) *molesta*, Busck, by means of allowing them to make hibernacula on sticks cut from pear limbs, which were then hung in an outdoor cage throughout the winter. A proportion of the sticks was sprayed with a variety of solutions, the toxicity of which was determined by the number of moths emerging from the sprayed and unsprayed sticks. All spraying was done on clear mornings when the temperature was above 32° F. Most of the solutions were applied during February and March, and a few in the previous November. Early spring spraying produced only slightly greater mortality. Variations owing to the loss of larvae through natural mortality and fungous attack, which was very evident on the unsprayed sticks, rendered comparisons exceedingly difficult. Mortality among untreated larvae ranged from 22 to 75 per cent., and in many cases exceeded that of treated larvae. Lists are given of those materials that decreased emergence to 60 per cent. or less of the check emergence and of those that proved ineffective. The highest mortality of 67 per cent. was secured with 10 per cent. nitrobenzene. Owing to the slowness of many of the materials in taking effect on the larvae, attempts to determine mortality by examination of the sticks prior to emergence proved impracticable.

Driggers (B. F.). **Recent Experiments on Oriental Peach Moth Control in New Jersey.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 209–215. Geneva, N.Y., February 1930.

The trend of infestation by *Cydia* (*Laspeyresia*) *molesta*, Busck, is traced during the past 12 years in New Jersey, where after a progressive decline from a 90 per cent. infestation in 1923 till 1927, a steady increase has occurred in 1928 and 1929. The status of control measures is also reviewed, and an account is given of experiments carried out in 1927 and 1929 in an attempt to develop a more effective and cheaper treatment. Nicotine sulphate and white oil emulsions failed to secure complete control against the first brood eggs. Fruit counts in an orchard sprayed with nicotine sulphate showed about 21 per cent. of the fruit injured, or about the same percentage of injury as that found in the previous year. Two years' spraying tests with pyrethrum-impregnated white oil emulsions, 1 : 100 or less, failed to control *C. molesta* when these sprays were applied at the time of appearance of the third brood eggs and larvae. Talc dust applied when the third brood eggs were hatching gave partial control in two orchards, but in a third the dust was found to hinder the work of the egg parasite, *Trichogramma minutum*, Riley, and no control was obtained. From studies of parasitism of *C. molesta* it was found that *Macrocentrus ancylivora*, Rohw., was responsible for most of the parasitism in southern New Jersey, whereas *Glypta rufiscutellaris*, Cress., was the principal parasite in northern New Jersey [*R.A.E.*, A, xvii, 389]. Experiments in 1928 and 1929 showed that larval parasitism by *M. ancylivora* could be increased in northern New Jersey by the liberation of this parasite during June, July and August.

Daniel (D. M.). **Oriental Peach Moth Parasite Work in New York.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 215–217, 1 ref. Geneva, N.Y., February 1930.

The following is the author's abstract : Results are given of two years' experiments in colonising *Macrocentrus ancylivora*, Rohw., in the area of new infestation of *Cydia* (*Laspeyresia*) *molesta*, Busck, in western New York. The parasite has apparently established itself in this region. *Glypta rufiscutellaris*, Cress., and *Ascogaster carpocapsae*, Vier., were found to parasitise *C. molesta* in western New York in 1927, although the percentage of parasitism was negligible. In 1928 *G. rufiscutellaris* parasitised 12 per cent. of the larvae of the peach moth, and in 1929 only 0·71 per cent. In both these years *A. carpocapsae* was of rare occurrence. In 1929 twig collections from the Hudson Valley and Long Island showed a parasitism by *M. ancylivora* of 51 and 89 per cent. respectively. Seven hundred thousand individuals of *Trichogramma minutum*, Riley, liberated in one orchard parasitised 36 per cent. of the season's eggs.

Phillips (E. F.). **Bees for the Orchard.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 218–223. Geneva, N.Y., February 1930.

The following is the author's abstract : The requirements for colony strength in order to have bees which will give good service in pollination of fruit is emphasised. The danger to bees from dusting of poisonous materials is discussed.

Hutson (R.). **A practical Honeybee shipping Cage for Use in Pollination.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 223–225. Geneva, N.Y., February 1930.

The following is the author's abstract : Observations on a shipping cage designed for use as a hive in the orchard indicate that it is possible for bees to be prepared at the shipping point for use in orchards. Bees prepared, shipped and used in this way compare favourably with packages hived in the orchard.

Back (E. A.), Cotton (R. T.) & Ellington (G. W.). **Ethylene Oxide as a Fumigant for Food and other Commodities.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 226–231, 2 refs. Geneva, N.Y., February 1930.

An account is given of ethylene oxide, a recently discovered gas which is an excellent fumigant for insects attacking all types of stored foodstuffs [*R.A.E.*, A, xvii, 87]. At ordinary temperatures it is a colourless gas, but at low temperatures it becomes a mobile colourless liquid boiling at 10·5° C. [51° F.]. The concentrated vapours of ethylene oxide are inflammable, but concentrations up to 3½ lb. per 1,000 cu. ft. of space are non-explosive and non-inflammable. The ignition point is 814° F. The gas is not highly toxic to man, but when inhaled produces cyanosis, which, however, is counteracted by the use of

carbon dioxide as an antidote. The cost of ethylene oxide is somewhat high owing to the present lack of commercial demand. It may be bought in small quantities for 4*s.* and in large quantities for 3*s.* per lb.

The recommendations given for atmospheric and vacuum fumigation with ethylene oxide are based on the results of numerous experiments conducted with different types of foodstuffs at a temperature of 75–78° F. to determine the proper dosages required to fumigate them successfully. A minimum dose of 1 lb. per 1,000 cu. ft. suffices for dried raisins and rice in bulk, but dried beans and rice in cartons require a double quantity of the fumigant, and nuts a maximum dose of 3 lb. per 1,000 cu. ft. Quicker results may be obtained by the use of a vacuum tank, but a correspondingly greater amount of the fumigant must be used. The use of carbon dioxide in combination with ethylene oxide has been found to increase the efficiency of the fumigant, and dosages for its use in vacuum fumigation are also given. In addition to increasing the insecticidal action, carbon dioxide, when mixed with ethylene oxide at the rate of 7 parts to 1 by weight, removes the possibility of fire hazard. The carbon dioxide is drawn into the vacuum tank first and is then followed by the ethylene oxide. Approximately 14 lb. of carbon dioxide per 1,000 cu. ft. is the dosage recommended except for the fumigation of nuts, when the amount should be doubled.

COTTON (R. T.). **Carbon Dioxide as an Aid in the Fumigation of certain highly adsorbtive Commodities.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 231–233, 1 ref. Geneva, N.Y., February 1930.

With a view to overcoming difficulties due to adsorption experienced in the fumigation of nuts, a series of experiments was carried out with adults of *Tribolium confusum*, Duv., placed in cotton-stoppered vials in the centre of small vacuum tanks of 8·7 and 21·76 litres capacity, filled with canvas bags containing raw peanuts, at a temperature of 72° F. Four glass vials, each containing 10 insects, were used in each test. When the tank was filled to capacity with peanuts, it was found impossible to obtain a 100 per cent. kill in 2 hours even with a dose of 48 oz. chloropicrin to 100 cu. ft. In tests with various mixtures of chloropicrin and carbon dioxide, 100 per cent. kill of *T. confusum* was secured with 7 oz. of chloropicrin when used with carbon dioxide at the rate of 2·8 lb., and with 4 oz. of chloropicrin when used with carbon dioxide at the rate of 4·2 lb. to 100 cu. ft. Higher percentages of carbon dioxide do not apparently increase the toxicity of chloropicrin beyond this point.

Experiments with ethylene oxide indicate that this gas is not absorbed by nuts to such an extent as is chloropicrin. With a tank filled with raw peanuts 11·2 oz. of ethylene oxide was required to 100 cu. ft. to give 100 per cent. kill in 2 hours, whereas 4 oz. of ethylene oxide was sufficient to secure the same result with the addition of 2·8 lb. of carbon dioxide to 100 cu. ft. Larger amounts of carbon dioxide did not materially increase the toxicity of ethylene oxide. Additional experiments with other highly adsorptive materials indicate that carbon dioxide can be used to advantage with other gases in the fumigation of many materials that have hitherto been difficult to fumigate successfully.

WISHART (G.). **Some Devices for handling Insects.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 234–237, 4 figs. Geneva, N.Y., February 1930.

Descriptions are given of several types of new apparatus for handling adult insects by means of suction, either by the mouth, by the operation of rubber bulbs or in connection with a vacuum cleaner [*R.A.E.*, A, xvii, 455].

ELLINGTON (G. W.). **A Method of securing Eggs of the Angoumois Grain Moth.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 237–238, 1 pl. Geneva, N.Y., February 1930.

An apparatus used to obtain the eggs of *Sitotroga cerealella*, Oliv., in large numbers is described in detail. The adults are collected as they climb up jars containing infested grain, or from window panes to which they have been induced to fly. About 30–50 adults are placed in a vial $4 \times 1\frac{1}{8}$ ins., which is closed by means of a pill-box cover held in place by a rubber band. Two strips of stiff cardboard clipped together are then introduced, a triangular cut being made in the end inserted first, to avoid crushing the moths. The eggs are laid in large numbers between the two strips, which should not be left longer than 2 days without being changed. Since most of the eggs are deposited 3–4 days after emergence, newly emerged adults should be collected daily in order to ensure a continuous supply of eggs.

HAMILTON (C. C.). **The Relation of the Surface Tension of some Spray Materials to Wetting and the Quantity of Lead Arsenate deposited.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 238–251, 6 charts, 6 refs. Geneva, N.Y., February 1930.

The following is taken from the author's summary : The theory of the wetting and spreading of sprays containing spreading materials is discussed. The materials tested were powdered skim milk and flour ; flour and lime ; saponin ; casein with lime ; and glue, the surface tension of all of which, when diluted so as to contain the same percentage of spreader material, does not greatly differ. The surface tensions rise somewhat slowly at dilutions containing 1 per cent. to 0·25 per cent., beyond which they increase at a much more rapid rate. The time required to wet clean glass plates and waxed glass plates was proportional to the surface tension. Waxed glass plates required a longer time to wet and incomplete wetting resulted at higher dilutions more quickly on them than on clean glass plates. Glue did not wet the waxed glass plates at any of the concentrations tested, whereas saponin wetted the waxed glass plates almost as readily as the clean ones. In most cases the quantity of lead arsenate deposited was in direct proportion to the surface tension of the spray material or the time required to wet. It is evident that as the surface tension of the spray material increased and the difficulty of wetting increased, a thicker film of spray liquid was required to give good wetting, and that this thicker film of spray liquid resulted in a greater quantity of lead arsenate being deposited upon the sprayed surface. The wetting ability of a spray material may be obtained by determining the time required to wet a uniform surface at different concentrations and different surfaces at the same concentration.

Headlee (T. J.). **The Effect of Pyrethrum Extract on Wireworms and upon Plants infested by them.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 251–259. Geneva, N.Y., February 1930.

An account is given of experiments carried out against wireworms in New Jersey in 1929 with pyrethrol, a solution containing 5 per cent. oleoresin of pyrethrum and 45 per cent. sodium oleate soap, which was found in field experiments to destroy the Elaterids without injuring the plants upon which they were feeding. It is diluted and poured on the surface of the ground about the base of the infested plants. Laboratory studies in which the dead and living larvae were counted 18 hours after treatment showed a mixture of 1 : 25 to be as effective as 1 : 15, and indicated that mortality is, in general, proportional to the strength used except where the strength of the solution becomes greater than the optimum. A concentration of 1 : 25 was found necessary to produce death when a drop of pyrethrol was placed directly on the jaws of the larva, and one of 1 : 15 proved more certain to accomplish this result. Soils through which the mixture penetrates were found to affect the toxicity of both the pyrethrum extract and the soap. This reduction in toxicity is least when the soil is composed exclusively of sand and increases as the clay component becomes larger. It has been indicated that physical adsorption is not alone responsible for this reduction in toxicity, although in the more colloidal materials it would be likely to be a much more important factor. The reduction in toxicity to wireworms varies with the depth it penetrates the soil. The reduction in the first 4 inches is not particularly great even where the soils are of a colloidal type. If deeper penetration is desired, therefore, more of the mixture should be applied to the surface.

In tests against *Aphis rumicis*, L., it was shown that a reduction in soap content through filtration is accompanied by reduction in toxicity, and replacement of soap content restores toxicity but never to its original point, indicating that pyrethrum extract is an important toxic agent in the combination. Filtration through 6 inches of soil gives a filtrate with 33·8 per cent. killing power. Replacement of lost soap in the same filtrate gives to the filtrate a killing power of 63·2 per cent., showing that soap is also an important factor in toxicity.

Burdette (R. C.). **The Effect of Talc on the Oviposition of a Trypetid.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 260–265, 2 refs. Geneva, N.Y., February 1930.

The results of field studies carried out against *Spilographa electa*, Say, which has been injurious to pepper [*Capsicum*] in New Jersey for the past 12 years, and against which all control measures hitherto tried have proved unsuccessful, appear to indicate that this fly is unable to deposit eggs where a thin film of talc dust is present upon the fruit at the period when it is attractive for oviposition. It also appears that *S. electa* is disinclined to alight upon or crawl over plants covered with the dust. This is probably due to the coating of the pulvilli with the dust, which renders the foothold of the insect uncertain. It is also possible that the fly is prevented from penetrating the skin of the pepper to oviposit, because it is unable to grip the surface with sufficient strength. Although the flies may alight upon dusted pepper plants, they do not appear, under field conditions, to be able to deposit any considerable number of eggs. Any failure to maintain a coating of dust on the

pepper plants when the fruit is in its attractive stage results in a prompt increase of infestation. About 10 applications of dust are required to maintain the coating on susceptible fruit during the flight period; the cost of these amounts to 8*s.* for material and 16*s.* for the cost of application for an acre.

King (J. L.) & Holloway (J. K.). **The Establishment and Colonization of** *Tiphia popilliavora*, **a Parasite of the Japanese Beetle.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 266–274, 2 maps. Geneva, N.Y., February 1930.

The following is taken from the authors' abstract and conclusions: The Scoliid, *Tiphia popilliavora*, Rohw., was introduced from Japan and established in New Jersey in 1921–23, when the present colony at Riverton was started with approximately 50 females. Definite recovery was made in 1926, when the parasite was found over an area of about 4 acres [*R.A.E.*, A, xv, 443]. In 1929 the colonised area had increased to 3½ sq. miles, within which numerous individuals of both sexes were seen feeding on the flowers of wild carrot (*Daucus carota*). Investigation in 1928 of 11 subcolonies of 100 females each that were founded in 1927 showed that 8 had become established, and about 33 further colonies were then started. In 1929, when the parasite was found to be very numerous at the centre of the original colony, 7 collectors during 17 days were able to collect 10,100 females. These were placed in 101 colonies of 100 each on the margins of the area heavily infested by *Popillia japonica*, Newm. There are at present about 134 colonies established throughout the infested region. A small number of liberations have also been made in the areas infested with *Anomala* (*Phyllopertha*) *orientalis*, Waterh., parasitism of which by *T. popilliavora*, however, has only occurred under artificial conditions.

As *T. popilliavora* has been found to maintain in the United States its specific habits in respect of *P. japonica*, is perfectly adjusted to its new environment, where its time of emergence and period of adult activity and larval development are identical with the corresponding periods in Japan, and is abundantly provided with *Daucus carota*, which it frequents almost to the exclusion of other plants, it is believed that it will prove to be one of the most important parasites acting in the biological control of the Japanese beetle.

Mehrhof (F. E.) & Van Leeuwen (E. R.). **An electrical Trap for killing Japanese Beetles.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 275–278, 2 pls., 2 figs., 2 refs. Geneva, N.Y., February 1930.

Preliminary experiments were carried out in 1927 in killing *Popillia japonica*, Newm., with alternating electric currents, the most satisfactory results being obtained with a frequency of 60 cycles and from 10,000 to 12,000 volts. On a wooden frame, bare copper wires were stretched parallel to each other at equal intervals. Alternate wires were connected together so that there was a difference in potential of 10,000 to 12,000 volts between any two adjacent wires. The interval between the wires was sufficient to prevent sparking, except when a beetle flies between two wires, in which case the resistance is decreased to

such an extent that a spark jumps from one wire to another through the beetle. An electric trap tested in a peach orchard during the summer of 1928 was constructed in the form of a hollow cube, 3 ft. on each edge, with the parallel conductor wires spaced $\frac{5}{8}$ in. apart on all four sides and on top, a geraniol bait being suspended in the centre. These dimensions were decided upon because it had been noted that beetles attracted by geraniol fly with the greatest activity within a radius of about 2 ft. from the attractant, and in a trap of this size beetles would be very likely to fly between the wires. Although coated with paraffin, the wooden frame used in this trap became damp after prolonged rains, and several of the joints failed electrically. This defect could be remedied by using metal frames and porcelain or other suitable insulators. In a test carried out from 1st-13th August in which the trap was raised to a height of 9 ft. in an open field 100 yds. from a peach orchard, beetles were killed at the rate of 150 a minute under most favourable conditions. There were no survivors among 150 beetles caught as they fell from the trap and observed at the end of 24 hours. The most effective bait was geraniol emulsion sprayed on peach branches, beetles being attracted from a distance of $\frac{1}{4}$ mile. The voltage should be high enough to kill the beetles and only slightly below the point at which the field will break down, and there should be sufficient impedance to prevent more than one discharge through the beetle as it flies between the wires. The trap consumed between 0·13 and 0·18 kilowatts an hour, according to the number of beetles killed, at an approximate cost of $\frac{3}{4}$*d.* an hour. The electric trap because of its great range of effectiveness and its high killing efficiency provides the best means for comparing the value of different attractants.

METZGER (F. W.) & GRANT (D. H.). **The Value of Smudges as Repellents for the Japanese Beetle.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 278–291, 1 pl. Geneva, N.Y., February 1930.

Tests in the use of smudges, undertaken as part of an investigation on repellents against the Japanese beetle [*Popillia japonica*, Newm.] in 1928 and 1929, indicated in the first year that it was necessary to develop a base that would burn slowly without attention, giving off at the same time considerable smoke. In the following year it was discovered that a mixture of wood flour and potassium nitrate containing about 10·7 per cent. potassium nitrate by weight, and made by dissolving the chemical in water and mixing it with the flour, possessed these qualifications and was comparatively cheap and easy to prepare. It was found that $1\frac{1}{4}$ lb. of the base could be mixed with 1 U.S. pt. of liquid or $1\frac{1}{4}$ lb. of solid repellent compound, without unduly retarding its burning rate, and these proportions were used in all cases. The mixture was placed in cylinders, 31 inches long and $2\frac{1}{4}$ inches in diameter, made of 16 mesh wire screening. These candles burned from 5 to 8 hours, according to the material that was incorporated with the base. The fumes from pine-tar oil, Dippel's oil (bone oil), and a commercial mixture of chloronaphthalenes, when given off by smudge candles, were found to be definitely repellent to *P. japonica*. Air currents in the field, however, prevented the materials tested from giving satisfactory control of the beetles, although as many as 3 candles were used to a tree.

HALLOCK (H. C.). **Some Observations upon the Biology and Control of** *Aserica castanea* **Arrow.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 281–286, 2 graphs, 2 refs. Geneva, N.Y., February 1930.

The information given on the life-history of *Aserica castanea*, Arrow, the history and distribution of which are briefly discussed, is based on work done from 1927 to 1929 by the United States Department of Agriculture. The first adult in 1929 was found on 25th June. Living adults have been found in the field concealed at the base of their food plants as late as 16th October. When the temperature is below 70° F., only a few of the beetles come out at night to feed and these are not active, but on warm nights they fly in swarms, and are attracted to lights. In one electric light trap 188,250 beetles were taken in 1928, and 107,690 in 1929. Mating occurs during the period of nocturnal activity and is continued together with oviposition at irregular intervals until autumn. Eggs are laid preferably in uncultivated places and in moist but not swampy ground ; although as many as 178 eggs have been deposited by one beetle in cages, the average number is about 60. They are laid in clusters of 1–19, and are found in the ground at depths of ½–4 inches, the majority being near the surface. They hatch in 10 days. About 25 per cent. of the larvae are still in the second instar when migration to winter quarters begins, about 15th October. Hibernation occurs at a depth of 9–15 inches, but the larvae can survive the winter nearer to the surface even when the ground is frozen hard. They return to the upper 4 inches about the middle of April and feed on grass roots until the middle of June. When the third instar larvae complete their growth, they prepare earthen cells 1½–4 inches below the surface in which they pupate, adults emerging 10 days later. There is a pre-pupal stage of 5 days. *A. castanea* feeds upon more than 50 species of food-plants, a list of 32 of which is given.

The application of lead arsenate to lawns in New York State has shown that the treatment used against *Popillia japonica*, Newm., and *Anomala orientalis*, Waterh. [*R.A.E.*, A, xviii, 272] will give protection against *Aserica castanea*, the larvae of which, however, tend to feed deeper in the ground. In the preparation of new lawns 3⅓ lb. acid lead arsenate mixed with 2 or 3 times its bulk of moist but not wet soil should be broadcast on the surface of each 100 sq. ft. The ground should then be thoroughly disked in order to work the lead arsenate to a depth of 3–4 inches before the seeds are sown. This treatment will be effective for 4–5 years. Plants severely attacked by adults should be sprayed with 3 lb. lead arsenate and 2 lb. wheat flour to 50 U.S. gals. water. In experiments with this spray during July and August 1929, the percentage of dead adults collected from the bases of the sprayed plants increased from 0 at the end of 24 hours to 54 at the end of 5 days, and 33 per cent. of those collected at the end of 9 days were dead. An oriental species of *Tiphia* which is normally parasitic on *Serica* has been found to attack *A. castanea* readily in the laboratory, and it is being bred for liberation at a point of heavy infestation in Long Island.

RONEY (J. N.). **A new pupal Parasite of the Sugar Cane Moth Borer,** *Diatraea saccharalis* **Fabr.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 286–287. Geneva, N.Y., February 1930.

Syntomosphyrum esurus, Riley, has been bred from a pupa of *Diatraea saccharalis*, F., taken from early maturing maize

in south-eastern Texas. According to A. B. Gahan, the only previous record of a pupal parasite of *D. saccharalis* is that of *Heptasmicra curvilineata*, Cam. [*R.A.E.*, A, xi, 113].

BIGGER (J. H.). **A Parasite of the Sunflower Weevil.**—*J. Econ. Ent.*, xxiii, no. 1, p. 287. Geneva, N.Y., February 1930.

An adult of the Chalcid, *Callimome albitarse*, Huber, was taken from a sunflower seed showing infestation by *Desmoris fulvus*, Lec., and containing remnants of weevil larvae. The infested seeds were obtained from Moultrie County, Illinois, on 24th November 1928, kept in storage until 8th April and examined on 13th April 1929. Adults of *Callimome* sp. were recorded from the heads of sunflowers in Colorado in 1915 [*R.A.E.*, A, iii, 753].

ESSIG (E. O.). **Nitidulid Beetle reared from Orange.**—*J. Econ. Ent.*, xxiii, no. 1, p. 287. Geneva, N.Y., February 1930.

A small Nitidulid beetle reared from an orange that was obtained from a market in San Francisco, California, on 2nd September 1929, was determined as *Epuraea* (*Haptoncus*) *luteola*, Er. A brief description of the beetle is given, with other records of its occurrrence in decayed fruits in various parts of North America.

NICKELS (C. B.) & PINKNEY (C. C.). **Notes on *Trichogramma minutum* Riley as a Parasite of *Acrobasis caryae* Grote.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 287–288. Geneva, N.Y., February 1930.

Parasitism to the extent of 24·6 per cent. was found among 511 eggs of *Acrobasis caryae*, Grote, that were collected from one pecan tree on which a few individuals of *Trichogramma minutum*, Riley, had been liberated during periods in August and September 1929. Adults of *T. minutum* were reared from the eggs of *A. caryae*, and some of them were successful later in attacking eggs of the same species from which they were reared. Examination after 5 days of 75 eggs of *A. caryae* that were placed in a petri dish on 18th September 1929 with a few individuals of *T. minutum* showed 71 to be parasitised.

DOUGLASS (J. R.). **Hibernation of the Convergent Lady Beetle, *Hippodamia convergens* Guér., on a Mountain Peak in New Mexico.** —*J. Econ. Ent.*, xxiii, no. 1, p. 288. Geneva, N.Y., February 1930.

Large numbers of *Hippodamia convergens*, Guér., have been observed for a number of years to hibernate on the summit of Mosca Peak, New Mexico, which rises to a height of 9,462 ft. above sea level and is covered with scrub oak, bunch grass and loose stone. On 29th September 1929 numbers of individuals were present on the peak, many others were seen approaching the summit and mating was observed. No

other Coccinellid has been noted among this colony, and Mexican bean beetles [*Epilachna corrupta*, Muls.] placed on the peak in cages failed to survive the winter.

MIDDLETON (W.) & SMITH (F. F.). **Note on a new Method of determining Efficiency in Control.**—*J. Econ. Ent.*, xxiii, no. 1, p. 289. Geneva, N.Y., February 1930.

Auditory observation has been found to be a good method of determining the efficiency of control of the boxwood leaf miner [*Monarthropalpus buxi*, Lab.], the larvae of which move within their mines on warm spring days, producing a faint but definite rustle in the infested bush, which can be distinctly heard by a trained observer. The value of such observations is very high, if they are made in spring from 1 to 4 weeks after fumigation. This is a more reliable method than that of larval examinations, since the larvae are invariably motionless when the leaves are opened immediately after treatment, whether they have been successfully fumigated or not, whereas later, when the stupefying effects of fumigation have worn off, the larvae that are fatally affected move from the stimulus given by the opening of the leaves in the same way as those unaffected. The auditory method, on the other hand, rests on the difference in behaviour within unopened leaves of normal or nearly normal larvae and those that have received a fatal dose of hydrocyanic acid gas.

NEWCOMER (E. J.) & SPULER (A.). **Suggestions for Use of Oil Sprays in 1930.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 289–290. Geneva, N.Y., February 1930.

The following suggestions, based on data accumulated from experimental work during the past three years, are put forward regarding the use of oil sprays in the North-west of the United States, with particular reference to apple and pear. Dormant oil sprays should be applied in the spring before the bud scales separate and before the buds show green. Injury may result if sprays are applied between the time the buds first show green and the cluster bud stage. There is no evidence that low temperatures following sprays applied in the spring during the dormant period result in injury. Oils of relatively low sulphonation test (50–70) can be safely used. Stable emulsions have proved safer than quick-breaking emulsions.

The number of applications of summer oils should not exceed 3, 2 being sufficient under most conditions. The use of oils alone has not given control of the codling moth [*Cydia pomonella*, L.]. Oils should be used only in combination with lead arsenate or nicotine sulphate. Oils in combination with lead arsenate should be applied during the height of the egg-laying period of the first brood, but if sulphur sprays are applied after the dormant period, no oil should be used in the first brood sprays. Because of difficulty in removing spray residue, combinations of oil and lead arsenate should not be used after 25th July, but nicotine sulphate and oil may be used after this date. Oils ranging in viscosity from 65–75 and having a sulphonation test of not less than 85 have proved most satisfactory, except that for varieties of apple susceptible to oil injury, the viscosity of the oil should not exceed 55. Oils in combination with lead arsenate should not be allowed to

stand in pipes or spray tanks, but should be applied immediately after being mixed, for fruit sprayed with such material can be cleaned only with great difficulty, and the mixture is ineffective in control.

Plummer (C. C.) & Pillsbury (A. E.). **The White Pine Weevil in New Hampshire.**—*Bull. New Hampshire Expt. Sta.*, no. 247, 32 pp., 4 figs., 17 refs. Durham, N.H., October 1929.

Pissodes strobi, Peck, all stages of which are described, is the most important pest of white pine (*Pinus strobus*) in New Hampshire, where this tree is grown over large areas, and it also occasionally attacks other species of pine and spruce. Previous work on this weevil is reviewed, and an account is given of a study carried out from the autumn of 1925 till September 1929, much of the data obtained being similar to those already noticed [*R.A.E.*, A, xiv, 581; xv, 406; xvii, 69; xviii, 247, 308]. In New Hampshire, the weevils emerge from hibernation in late April or early May; a female may lay 25–201 eggs in a season, the oviposition period terminating about the middle of July. Some weevils, however, hibernate a second time and oviposit again in the following season. The egg, larval and pupal stages last 5–20, 26–41 and 9–20 days respectively, the time required for total development averaging 53–56 days. The newly-emerged adults remain in the leader for several weeks before coming to the surface of the tree.

Brief notes are given on the parasites associated with *P. strobi*, all of which were recorded in a previous paper [xviii, 247], but the most important single factor of control in New Hampshire is *Lonchaea corticis*, Taylor, the larvae of which are predacious on those of the weevil in their tunnels and also attack the pupae and, to a less extent, the adults. They are responsible for a reduction of about 50 per cent. of the numbers of the weevil larvae.

P. approximatus, Hopk. (northern pine weevil) was found attacking the trunk and roots of white pine. Its life-history appears to be similar to that of *P. strobi*, and it may even prove to be identical with the latter, which was shown experimentally to be able to breed in the trunk of a weakened tree.

Cutright (C. R.). **A significant Feature of Biotic Potential as related to Insect Control.**—*Ann. Ent. Soc. Amer.*, xxiii, no. 1, pp. 145–148, 2 figs., 3 refs. Columbus, Ohio, March 1930.

The author discusses the importance of biotic potential [defined by Chapman as the inherent power of an organism to reproduce and survive, that is, to increase in numbers] in the control of injurious insects. When a control measure 94–98 per cent. effective is used against an insect with a biotic potential as low as that of the round-headed apple tree borer [*Saperda candida*, F.], the insect will undoubtedly be controlled for that season and usually for 2–5 succeeding years as well, unless such factors as migration intervene. The same percentage of control in northern Ohio will hold the codling moth [*Cydia pomonella*, L.], the biotic potential of which is higher, in check for a year but not longer. A control as high as 98 per cent. at the beginning of a season, however, is not sufficient to hold in check the European red mite [*Paratetranychus pilosus*, C. & F.], or to a greater extent the green apple aphis [*Aphis pomi*, DeG.], for the remainder of the year.

Breakey (E. P.). **Contribution to a Knowledge of the Spindle Worm,** *Achatodes zeae* **(Harris) Lepidoptera, Noctuidae.**—*Ann. Ent. Soc. Amer.*, xxiii, no. 1, pp. 175–192, 1 chart, 8 refs. Columbus, Ohio, March 1930.

A detailed account is given of the biology of *Achatodes zeae*, Harr. (spindle worm) in Wisconsin, where it differs very slightly from that in other States [*cf. R.A.E.*, A, xviii, 282].

Parasites of *A. zeae* include *Microplitis gortynae*, Riley, which infested 10 per cent. of the larvae collected in the field, *Lissonota* sp. (probably *L. brunnea*, Cress.), *Psychophagus omnivorus*, Wlk., *Amblyteles coeruleus*, Cress., *A. brevicinctor*, Say, and *Ephialtes aequalis*, Prov. About 30 per cent. of *M. gortynae* were parasitised by *Eupteromalus dubius*, Ashm. [*cf.* xviii, 116], several adults of which also emerged from a few cocoons of *Lissonota*. Quantitative data indicate that as a result of the activities of natural enemies less than 33 per cent. of the mature larvae of *A. zeae* reach the adult stage.

Rosewall (O. W.). **The Biology of the Book-louse,** *Troctes divinatoria*, **Müll.**—*Ann. Ent. Soc. Amer.*, xxiii, no. 1, pp. 192–194, 1 fig. Columbus, Ohio, March 1930.

Troctes divinatoria, Müll., was found heavily infesting maize-meal, and observations were made on its life-history in this material. The technique employed is described. No males were found, and parthenogenesis always occurred. The rate of oviposition and lengths of the developmental stages varied with the temperature. At temperatures ranging from 50–87° F., during the months of October to January, the egg stage averaged 21 days and the life-cycle 110, as compared with 6·9 and 24·4 days in summer with temperatures of 60–95° F. The average number of eggs laid by a female was 20 in October–January and 57 in summer.

Hoggan (I. A.). **Studies on Aphid Transmission of Plant Viruses.**—*J. Bacteriology*, xix, no. 1, pp. 21–22. Baltimore, Md., January 1930.

The determination of the part played by various Aphids in the transmission of specific plant viruses is of both fundamental and practical interest. That the virus of ordinary tobacco mosaic is transmitted by Aphids has recently been laid open to question. Greenhouse trials have now demonstrated that *Myzus solani*, Kalt. (*pseudosolani*, Theo.) and *Macrosiphum gei*, Koch (*solanifolii*, Ashm.) can transmit this virus from tomato to various solanaceous hosts, although they are apparently incapable of doing so from tobacco. These Aphids readily transmit the cucumber mosaic virus from both tobacco and tomato, as does *Myzus circumflexus*, Buckt. The latter also appears unable to transmit the virus of ordinary tobacco mosaic from tobacco, thus resembling *M. persicae*, Sulz. [*R.A.E.*, A, xvii, 282]. No adequate explanation can yet be offered to account for this peculiar selective capacity of the Aphids with respect to the virus and the plant.

It therefore appears that *M. solani* and *Macrosiphum gei* may be factors in the dissemination of ordinary tobacco mosaic on tomato, but that none of the Aphids studied is likely to be of importance in the dissemination of this disease in tobacco fields.

Flint (W. P.), Dungan (G. H.) & Young (A. L.). **Corn-borer Developments during 1929.**—*Circ. Illinois Agric. Expt. Sta.*, no. 350, 4 pp., 1 fig., 1 map. Urbana, Ill., February 1930.

In 1929 the European corn borer [*Pyrausta nubilalis*, Hb.] had advanced to within 15 miles of the eastern border of Illinois. In experiments on the susceptibility of various strains of maize, infestation in the most resistant strain averaged 6 per cent., and in the least resistant 58·6 per cent. In the previous year the same two varieties showed 9·8 and 62·6 per cent. infestation respectively. In general, low-growing and therefore comparatively low-yielding, varieties were lightly infested. A few high-yielding strains, however, both in 1928 and 1929 showed a fairly low infestation.

Treating the maize stalks in such a manner that they are laid flat on the ground before being ploughed under appears to facilitate covering them completely with soil. Where crops such as oats are to be sown without ploughing the ground, very thorough raking and clean burning may prove to be the best solution.

Brower (A. E.). **An Experiment in marking Moths and finding them again (Lepid.: Noctuidae).**—*Ent. News*, xli, nos. 1 & 2, pp. 10–15, 44–46, 1 pl. Philadelphia, Pa., January & February 1930.

Species of *Catocala* were used in these experiments, which were conducted in Missouri from 24th July till 6th August 1929. Lacquers, thick oil or enamel paints were used for marking the moths, the first named proving the most satisfactory. When enamels were used, the scales had to be partly removed. Fine, short-bristled enamel brushes were employed. A different colour was used in each locality. Each individual of a species received a different mark or combination of marks, and each was given a consecutive number, a sketch being made of the marked wing or wings. Before being marked, the moths were stupefied in a jar containing sodium cyanide. This method had apparently no ill effect on them, since, if turned out of the jar as soon as struggling had ceased, they were often able to crawl up a tree by the time the data had been recorded.

Cole (A. C.). *Muscina stabulans* **Fall. (Diptera: Muscidae) parasitic on** *Arachnara* [*Archanara*] *subcarnea* **Kell. (Lepidop.: Noctuidae).**—*Ent. News*, xli, no. 4, p. 112. Philadelphia, Pa., April 1930.

Two larvae of *Muscina stabulans*, Fall., emerged from a pupa of the Noctuid, *Archanara subcarnea*, Kell., taken from a stem of *Typha latifolia* about 4 inches below the surface of the water. It is probable that the host is attacked in the larval stage. The author believes this to be the first record of parasitism by *M. stabulans* [but *cf. R.A.E.*, A, ix, 587; x, 46; xi, 405; xv, 474; xvi, 236; xvii, 251.]

Stearns (L. A.). **Recent Developments in Oriental Fruit Moth Control.**—*Trans. Peninsula Hort. Soc.*, 1929, pp. 20–27. Dover, Del. [1930.]

The spread of the oriental fruit moth [*Cydia molesta*, Busck] in 1929 in the Eastern States is briefly reviewed. Peach infestation has been generally above normal with localised severe injury to quinces,

pears and late apples. Conditions of parasitism are encouraging, although out of approximately 50 parasitic enemies of the moth [*R.A.E.*, A, xviii, 122, 163] only three species, *Trichogramma minutum*, Riley, *Macrocentrus ancylivora*, Rohw., and *Glypta rufiscutellaris*, Cress., occur in sufficient numbers to effect a noticeable reduction of the host [*cf.* xvii, 195, 272, 388]. The work carried out in different States with a view to rearing and liberating these parasites is briefly outlined. The possibility of controlling *C. molesta* by insecticides is discussed. The results of laboratory tests and orchard spraying experiments indicate that heavy applications of hydrated lime either alone or in combination with insecticides offer an adequate control for *C. molesta*, as the lime acts as a mechanical hindrance to oviposition, hatching and larval entry [xvii, 388, 723]. The records of fruit infestation indicate that so long as the foliage and fruit were heavily coated with hydrated lime spray, the infestation was abnormally light. A spraying and dusting schedule, in accordance with which peach growers in Ohio treated their plantations, is given; the results indicate a greater effectiveness of the hydrated lime spray as compared with the application of talc dust. A better set of fruit was observed on the limed trees, and an increase in crop, due to the larger size of peaches, was obtained.

Most of the supplementary control measures recommended have already been noticed [xvii, 315]. In making new plantations, it is advisable to separate as widely as possible early and late varieties of peaches and to restrict the interplanting of peaches and apples. Peaches should be pruned moderately, since the over-pruned and over-stimulated trees are the most severely injured.

WILLIAMS (L. L.) & DOZIER (H. L.). **Life History Studies of the Plum Curculio in Relation to Fruit Infestation in 1929.**—*Trans. Peninsula Hort. Soc.*, 1929, pp. 39–42, 2 figs. Dover, Del. [1930].

In continuation of previous work [*R.A.E.*, A, xvii, 389], further studies on the seasonal life-history of *Conotrachelus nenuphar*, Hbst. (plum curculio) in Delaware were carried out in 1929. The dates of emergence of the overwintered weevils, oviposition, etc., are given. The spring was unusually warm, and a marked correlation between emergence and temperature was noticed; maximum emergence occurred in the central part of the State, the first adults appearing on 6th April, 15 days earlier than in 1928. In the south 89 per cent. of the grubs of the first brood emerged from fallen peaches between 24th May and 2nd June, and picking up and destruction of such fruit before the larvae had started to abandon them would have been an effective control measure. In the central part all first brood adults hibernated, while in the south a partial second brood developed, which resulted in severe injury late in the season.

NEAVE (S. A.). **A Summary of Data relating to Economic Entomology in the British Empire.**—Med. 8vo., 23+2 pp. London, Imp. Bur. Entom., 1930. Price, 2*s.* 6*d.*

In this paper, which was prepared for the Third Imperial Entomological Conference, an attempt is made to summarise the expenditure incurred by entomological departments in the British Empire. It is pointed out that the United States, with a population of some

106,000,000, spends at least £2,000,000 a year and employs not less than 500 entomologists, while the British Empire, with a population more than four times as numerous, spends little more than one-fourth of this and employs less than 300 entomologists. It is also shown that if the expenditure on entomology in relation to total revenue was on the same basis as in the United States, the British Empire would be spending nearly seven times as much as it actually does. Thus it is open to question whether the Empire is bearing its share in the fight between man and insects. The contrast is greater when the dissimilarity of conditions is considered, as the problems of the United States, though on a vast scale, are limited in variety, and neglect of them would not be specially dangerous to the rest of the world, while the responsibility of an Empire scattered throughout the world and concerned with a greater range of pests and crops is a much heavier one.

Taylor (J. S.). **Notes on the Bionomics of** *Xanthodes graellsi* **Feisth. (Noctuidae) in the Eastern Transvaal, with Description of Eggs, Larva and Pupa.**—*Ent. Mem. Dept. Agric. S. Afr.*, no. 6, pp. 5–8, 8 refs. Pretoria, 1929.

Xanthodes graellsi, Feisth., the immature stages of which are described, has been recorded on cultivated cotton in India, the Sudan, Nyasaland, Tanganyika Territory and South Africa, and it also feeds on wild malvaceous plants. In the eastern Transvaal it has at least six overlapping generations during the season, the first larvae appearing during October. It does not, however, cause much damage, except occasionally early in the season. The eggs, which are deposited singly on the food-plant, hatch during January and February after 4 or 5 days, and the larval period occupies from 16 to 33 days. When full-grown, the larva burrows in the soil to a depth of ½ to 1½ inches, where it pupates a few days later. Larvae entering the soil late in the season do not pupate until the following spring. The time spent in the soil during November to January was 19–26 days, and during February and March, 24–30 days, with an average pupal period, during December and January, of 22 days. The adult emerges at night, oviposition beginning 4–6 days later ; one female deposits as many as 196 eggs. The Tachinid, *Zenillia illota*, Curran, two other Tachinids, and a Braconid, have been reared from the larvae ; towards the end of the season, parasitism by the Tachinids is fairly high, and is probably a factor in preventing *X. graellsi* from becoming a more serious pest.

Munro (H. K.). **Biological Notes on the South African Trypetidae. (Fruit-flies. Diptera.) III.**—*Ent. Mem. Dept. Agric. S. Afr.*, no. 6, pp. 9–17. Pretoria, 1929.

These notes are a continuation of those previously noticed [*R.A.E.*, A, xvi, 303], and they deal with a further 33 species, including *Dacus brevistylus*, Bez., of which an apparently exceptional infestation was found on tomato at Pretoria. A few new host-fruits of *Ceratitis capitata*, Wied., are recorded, but recent enquiries seem to show that grapefruit is not infested by this fly in South Africa. An infestation, apparently severe, of pears by *Ceratitis* (*Pterandrus*) *rosa*, Ksh., is recorded ; it has not been previously known to attack this fruit.

RIPLEY (L. B.) & HEPBURN (G. A.). **Studies on Reactions of the Natal Fruit-fly to Fermenting Baits.**—*Ent. Mem. Dept. Agric. S. Afr.*, no. 6, pp. 19–53, 6 charts, 15 refs. Pretoria, 1929.

This paper, which was apparently written in 1926, before one recently noticed [*R.A.E.*, A, xviii, 197], is a preliminary report on investigations in Natal made for the purpose of developing the most efficient bait for the Natal fruit-fly, *Ceratitis* (*Pterandrus*) *rosa*, Ksh. The Mally fruit-fly bait-spray [i, 195] is not satisfactory against this species at Cedara, probably because summer rains and mist afford abundant moisture for the flies, and Newman's pollard bait [xii, 411] has been modified to increase its efficiency, the formula recommended being 6 to 8 lb. pollard, 2 lb. treacle, 3 oz. pure bi-sodium hydrogen arsenate (or pure arsenious oxide) amd $1\frac{1}{2}$ lb. borax, made up to 10 gals. with water. If arsenious oxide is used, it must first be dissolved in hot water. About 136 sq. ins. of surface should be exposed in open containers for each gallon of bait used, and the latter renewed every 3 to 5 weeks, according to weather conditions. Upon evaporating nearly to the paste stage, it should be brought up to its original volume by adding water as often as necessary until renewal. The maximum attractiveness of the fermenting bait is correlated with the highest rate of acid formation; when putrefaction becomes marked the formation of attractants is greatly reduced. Borax was found to be the best preservative for controlling the decomposition along the desired lines. Various grains, as well as treacle and fruit juices, liberate attractants during fermentation, but pollard ferments at about the desired rate. Treacle alone, at its optimum dilution (about 1 : 12), remains attractive longer than pollard bait and evaporates more slowly, but is much less attractive during the first few weeks. The poisons in the above formula act neither as olfactory nor gustatory repellents. The attracting odours do not act differently upon the two sexes and are probably "food odours." The alcohols containing fusel oil and also turpentine are repellents. New methods are described for determining the relative attractiveness of baits, the relative toxicity of poisons and gustatory repellency.

RIPLEY (L. B.) & HEPBURN (G. A.). **A new Olfactometer successfully used with Fruit-flies.**—*Ent. Mem. Dept. Agric. S. Afr.*, no. 6, pp. 55–74, 7 figs. Pretoria, 1929.

The McIndoo olfactometer [*R.A.E.*, A, xiv, 456] and various modifications having failed to operate with the Natal fruit-fly, *Ceratitis* (*Pterandrus*) *rosa*, Ksh., or with house-flies [*Musca*], a new type of olfactometer has been developed and is here described in detail and illustrated. Eight equal currents of air, which are made to carry the odours by being passed through liquids, are sucked into a wire gauze cage containing the flies through eight symmetrically placed holes, and out through a single opening at the bottom. Each of the eight openings leads to a trapping bottle, which retains the flies attracted. This has been found to give definite results with *C. rosa*, and has enabled the investigator to determine the relative attactiveness of different odours [see preceding paper]. The apparatus has also proved that the attractive principles of a bait can be concentrated by distillation, and it will probably also serve for testing repellents. With slight modifications, it may be useful in work with other insects.

RITCHIE (A. H.). **Entomological Work.**—*Ann. Rep. Dept. Agric. Tanganyika Terr., 1928–29*, pt. ii, pp. 29–34. Dar-es-Salaam [1930].

An account is given of experimental rearings of mulberry silkworms [*Bombyx mori*, L.], and the diseases attacking them, which included flacherie, grasserie and muscardine, are discussed. Mulberry was attacked by the Lamiid, *Inesida leprosa*, F., which infested the old neglected plants and also breeds in neglected areas of ceara rubber [*Manihot glaziovii*] thoughout the Territory. A species of *Icerya* (? *aegyptiaca*, Dougl.) occurred on the hedge mulberry (*Morus indica*) ; the plants become completely whitened with a dense covering of the scale, and if no action is taken, are killed back to the root stock.

Owing to the lack of rainfall in the early months of 1929, coffee was seriously affected by *Physothrips xanthoceros*, Hood, which even occurred at the uppermost limits of the crop (over 5,000 ft.) ; there is evidence to show that lime-sulphur (1 : 40), applied in late December or January, tends to prevent the spread of the thrips. The dry weather also favoured the increase of *Coccus* (*Lecanium*) *viridis*, Green, and two sprays of lime-sulphur (1 : 15) at a 10-days' interval were necessary to effect control. The coffee bug, *Antestia lineaticollis*, Stål, caused considerable loss. The mealybugs, *Ferrisia virgata*, Ckll., and *Pseudococcus perniciosus*, Newst. & Willc., occurred in the northern coffee districts, but were largely controlled by the predatory larvae of *Eublemma costimacula*, Saalm. The incidence of insect pests on cotton was very low ; infestation by *Platyedra gossypiella*, Saund., at the close of the season averaged only 8 per cent. of the locules of the bolls.

There were three invasions of *Schistocerca gregaria*, Forsk., of which the first two, consisting of yellow (sexually mature) locusts, appeared in the northern part of the Territory during March–May and November–December, respectively. Control measures were undertaken against larvae resulting from the second invasion, but no serious damage was caused in either case. An outstanding feature was the immediate effective control exercised by the Muscid fly, *Stomatorhina lunata*, F. The third invasion, which began at the end of January, was more serious ; dense swarms of red (immature) locusts flew south across the northern boundary, but the damage to crops was less than might have been expected.

SMEE (C.). **Report of the Entomological Division.**—*Ann. Rep. Dept. Agric. Nyasaland 1929*, pp. 13–21, 5 refs. Zomba [1930].

No report was issued for the year 1928, the work done in the early months being included in the report for 1927 [*R.A.E.*, A, xvii, 172] and the remainder in the present one.

The tobacco beetle, *Lasioderma serricorne*, F., was found in July, October and November in the North Nyasa district breeding in a cotton field in old, shrivelled bolls, which had previously been attacked by cotton stainers and other insects ; cleanliness in buildings and the frequent destruction of all scrap and waste tobacco are recommended, while cotton should not be grown in the vicinity of buildings in which tobacco is handled, nor seed-cotton stored in them. Treatment with steam is the best method of dealing with tobacco infested with this beetle ; in a plant giving a pressure of about 45–50 lb. per square inch

steaming for $2\frac{1}{2}$ minutes kills all stages of the beetle in leaf tobacco, but not less than 5 minutes should be given for tobacco hung up in bands or spread out on trays. *Dereodus recticollis*, Mshll. (yellow stem grub) [xvi, 74] is a serious pest where it occurs ; its presence in all probability depends on the plants that are in existence when tobacco is not present and that serve as food-plants for the adult weevil. Early in the year *Nezara viridula*, L., and *N. robusta*, Dist. (green shield bugs), which usually feed on cotton, castor, beans, etc., sucked the stems of young tobacco plants just below the bud, producing a wilting, though no serious damage was caused. *Engytatus volucer*, Kirk., which is new to Nyasaland, was found in considerable numbers in March feeding on experimental tobacco plants near Zomba, and ovipositing during October on native tobacco in North Nyasa.

With a view to finding out if the embargo imposed in 1925 on cotton growing in the North Nyasa district on account of the presence of *Platyedra gossypiella*, Saund. (pink bollworm) had restricted the development of the pest, the growing of test plots of cotton during 1928 and 1929 was arranged, and in 1929 these were thoroughly examined in July, October and November ; as no *P. gossypiella* was found, the suggestion was made that the embargo might be removed, under certain conditions, and this action was subsequently sanctioned. During the search for *P. gossypiella*, larvae and pupae of *Mometa zemiodes*, Durrant, which bear a striking resemblance to those of the pink bollworm, were found in old or diseased cotton bolls. Late-planted cotton near Port Herald suffered in May and June from a serious outbreak of *Prodenia litura*, F. (*littoralis*, Baisd.), (cotton worm), but later parasites, especially a Tachinid (*Sturmia* sp.) became very numerous, and the larvae were also attacked by the nymphs and adults of the Pentatomid, *Macrorhaphis spurcata*, Wlk., which is known to prey on cotton bollworms.

Tea continued to remain free from insect pests of a really serious nature [xvii, 172]. *Tetranychus bioculatus*, W.M. (red spider) appeared in new and unexpected places, being readily transported on the bodies and clothing of field workers. As this mite survives from one season to the next by means of eggs placed in crevices in the stems of the tea bush, the whole bush should be sprayed or dusted with sulphur before it has made itself evident on the foliage. Young tea plants were attacked by *Dicasticus mlanjensis*, Mshll. [*cf.* xvi, 75] and *Systates smeei*, Mshll. ; both weevils are probably introduced into tea gardens with *Cajanus indicus*, used as a green manure.

On coffee *Antestia faceta*, Germ. (*variegata*, Thunb.) increased, but was somewhat controlled by an egg parasite, probably *Telenomus truncativentris*, Dodd. The larvae of *Leucoptera coffeella*, Guér. (coffee leaf miner) produced brown-coloured blisters on the leaves, mining under their upper surface ; the main emergence of the moth seems to take place in the dry season, particularly in August, by which time parasitism is high, three species of Chalcids having been reared. The Aphid, *Toxoptera aurantii*, Boy., was found occasionally on coffee, but was not of great importance. A parasitic Ichneumonid (*Charops* sp.) has been bred from the larvae of *Parasa vivida*, Wlk., which were only of sporadic occurrence, and a Chrysidid from the pupa. It was found that *Ceroplastes ceriferus*, And. (wax scale), which sometimes infests coffee, was identical with a scale occurring in enormous masses on *Cedrela toona*, although the form on coffee is considerably smaller. The crop may, however, be attacked, even

if *Cedrela* is not present, as this scale is indigenous and coffee is one of its food-plants.

Maize was attacked by *Systates perblandus*, Mshll., as a result of the removal of its natural food-plants, *Bidens pilosa* and *Amarantus* sp., when weevils are present. In captivity eggs were laid in a fold of the leaf of *B. pilosa* only, though both plants were available ; on hatching, after 8–12 days, the grubs fall to the ground and burrow into the soil, the adults emerging a year later. The female lays large numbers of eggs, and in one case over 900 were laid in 71 batches during a period of about 2½ months. *Sorghum* was somewhat severely damaged early in the year in native gardens by a species of *Chilo*, which was parasitised by the Braconid, *Apanteles sesamiae*, Cam., and an Ichneumonid.

Pests of miscellaneous crops included the larvae of a Cossid moth boring in castor oil plants ; and *Virachola antalus*, Hpff., and *Lampides baetica*, L., bred from the seedpods of sunn hemp [*Crotalaria juncea*]. *Cajanus indicus* was rather severely infested by an Aphid, and the roots harboured a mealybug, the development of which was very marked in the second year on ratooned plants.

Cedrela toona was heavily infested by *Ceroplastes ceriferus*, the outstanding fact being that single trees or avenues of reasonably spaced trees were not attacked, while those in a plantation were covered with masses of the scale. Mahogany was defoliated by the larvae of a Lymantriid, *Heteronygmia leucogyna*, Hmps., and a Mlanje cedar [*Widdringtonia whytei*] was attacked by those of *Amphicallia thelwalli*, Druce, and *A. bellatrix*, Dalm., a parasitic fly, *Polychnomyia flavohalterata*, Bisch., being reared from them.

A long-horned grasshopper, *Homorocoryphus vicinus*, Wlk., was reported from Port Herald to be doing considerable damage to ripe millet and maize cobs ; it has been seen flying in small clouds at dusk, whereas previously only isolated specimens had been taken in the Shire Highlands. Swarms of *Oxyrrhepes procera*, Burm., *Cataloipus cognatus*, Wlk., and *Cyrtacanthacris aeruginosa*, Stoll., appeared in some districts, but no serious damange was caused to the native crops.

Trägårdh (I.). **Some Aspects in the Biology of Longicorn Beetles.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 1–8, 6 figs., 10 refs. London, March 1930.

The author discusses some of the less well-known features in the bionomics of Longicorn beetles [*R.A.E.*, A, xviii, 268].

Gardner (J. C. M.). **The early Stages of** *Niponius andrewesi*, **Lew. (Col. Hist.)**.—*Bull. Ent. Res.*, xxi, pt. 1, pp. 15–18, 1 pl. 1 fig. London, March 1930.

The full-grown larva, prepupa and pupa of the Histerid, *Niponius andrewesi*, Lew., from India, are described. The larval characters do not differ in any fundamental from those of other Histerids, and the author therefore considers that this species should be regarded as a true member of this family adapted to a special mode of life, preying, as it does, on the early stages of certain Scolytids. It has been reared frequently from *Shorea robusta* attacked by *Sphaerotrypes siwalikensis*, Stebb., at Dehra Dun.

Laing (F.). **A new Genus and two new Species of Coccidae from the Solomon Islands.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 19–22, 2 figs. London, March 1930.

Neosimmondsia hirsuta, gen. et sp. n., and *Heterococcus painei*, sp. n., are dsecribed from coconut in the Solomon Islands.

Wilkinson (D. S.). **A Revision of the Indo-Australian Species of the Genus** *Microplitis* **(Hym. Bracon.).**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 23–27. London, March 1930.

The species dealt with include: *Microplitis perelegans*, Bingh., from *Notodonta cycnoptera*, Low., and *M. basilis*, Bingh., from the Sphingids, *Theretra oldenlandiae firmata*, Wlk., and *Cephonodes kingi*, McLeay, in Queensland; *M. maculipennis*, Szép. (*eusirus*, Lyle, *ophiusae*, Ramakrishna Ayyar), which was described from New Guinea and is now recorded from the Noctuid, *Achaea janata*, L., in India; and *M. similis*, Lyle, from the Noctuid, *Agrotis ypsilon*, Hufn., in India. A key is given to the Indo-Australian species of the genus.

Krishna Ayyar (P. N.). **A Note on** *Stibaropus tabulatus*, **Schiö. (Hem., Pent.), a new Pest of Tobacco in South India.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 29–31. London, March 1930.

The Pentatomid, *Stibaropus tabulatus*, Schiödte, which has apparently never been been recorded previously as a pest of economic importance, has recently been discovered near Coimbatore living underground and attacking the roots of tobacco. The infestation was found only in one garden of about 10 acres, where the soil was peculiarly adapted to subterranean insects, and caused gradual weakening and dying of the plants. The bugs were found at depths varying from 1 to 6 inches, and averaged 10 to 20 on each plant, though sometimes there were as many as 30. The source of the infestation could not be found. The eggs were deposited singly in the soil at depths varying from 3 to 6 inches near the roots or rootlets of the tobacco plants. After 4–15 days the nymphs hatch, and, if placed on the surface of the soil, at once burrow into the ground. It was found that the bug could be almost completely destroyed without injury to the plants by applying crude oil emulsion in the proportion of 1 lb. in 6 gals. of water mixed with a tobacco decoction (1 lb. soaked in 1 gal. of water all night and then diluted with an equal quantity of water). This was sufficient for about 80 plants. Light traps proved of little value.

Ferrière (C.). **On some Egg-parasites from Africa.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 33–44, 6 figs. London, March 1930.

The species dealt with, all of which were obtained from the eggs of their hosts, include the Eupelmids, *Anastatus blattidarum*, sp. n., from a cockroach in the Sudan; *A. bifasciatus*, Boy., from a Lasiocampid, and *A. bifasciatus* var. *antestiae*, n., and *A. bifasciatus* var. *hancocki*, n., from the Pentatomid, *Antestia lineaticollis*, Stål, all in Uganda; and *Mesocomys pulchriceps*, Cam., from Lepidoptera, and recorded (probably erroneously) from the larva of the Calliphorid, *Chrysomyia chloropyga*, Wied., in South Africa; the Eulophid, *Tetrastichus ovulorum*, sp. n., from the Coccinellid, *Epilachna chrysomelina*, F., in Sierra Leone; *Trichogramma lutea*, Gir., from

Diparopsis castanea, Hmps., in Natal; the Mymarids, *Anaphoidea gonipteri*, sp. n., from *Gonipterus scutellatus*, Gyll., in Australia; *Anagrus cicadulinae*, sp. n., from *Cicadulina* (*Balclutha*) *mbila*, Naudé, in Natal; and *Alaptus andersoni*, sp. n., from a Psocid on coffee, in Kenya Colony; and the Scelionid, *Scelio zolotarevskyi*, sp. n., from *Locusta migratoria migratorioides*, R. & F., in Madagascar. *Anaphoidea gonipteri* has been established in South Africa, and introduced into New Zealand against *G. scutellatus* [*cf. R.A.E.*, A, xvii, 61, 606]. A key is given to the Australian species of *Anaphoidea*.

MAULIK (S.). **New Injurious Hispinae.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 45–56, 8 figs. London, March 1930.

The new species described include: *Craspidonispa saccharina*, on sugar-cane in Trinidad; *Xenochalepus mucunae*, on *Mucuna pluricostata*, *Codiohispa* (gen. n.) *anonicola*, on *Anona squamosa*, and *Cnestispa* (gen. n.) *darwini*, on *Cymbotoma*, all in Brazil; *Gyllenhalius palmarum* on oil palm and coconut in the Gold Coast; and *Wallaceana phoenicia*, on the palms, *Oncosperma tigillaria*, the wood of which is used for building, and *Zalacca conferta*, in the Malay Peninsula. *Acanthodes flavipes*, Baly, is referred to *Cnestispa*.

ROBERTS (A. W. R.). **A Key to the principal Families of Coleoptera in the Larval Stage.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 57–72, 7 figs., 92 refs. London, March 1930.

A key is given to the larvae of the principal families of Coleoptera, the author's aim being to tabulate some of the data obtained by various workers since the publication of Macgillivray's key more than 25 years ago.

TAMS (W. H. T.). **A Note on certain Species of the Genus** *Tirathaba*, **Walker (Lepid., Pyral.).**—*Bull. Ent. Res.*, xxi, pt. 1, p. 73, 1 pl. London, March 1930.

The characters distinguishing *Tirathaba ruptilinea*, Wlk., *T. rufivena*, Wlk., and *T. mundella*, Wlk., are indicated; the first two were erroneously treated as con-specific by Hampson.

TAMS (W. H. T.). **Two new Moths with Larvae injurious to Coffee in Uganda.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 73–75, 1 pl. London, March 1930.

The Drepanid, *Metadrepana marantica*, sp. n. (which has for some years been confused with *M. glauca*, Hmps.), and the Limacodid, *Parasa hexamitobalia*, sp. n., are described from coffee in Uganda.

TAMS (W. H. T.). **A new Moth damaging Oil-palm in the Belgian Congo.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 75–76, 1 pl. London, March 1930.

The Pyralid, *Pimelephila ghesquieri*, gen. et sp. n., is described from the Belgian Congo, where the larva damages the oil-palm, *Elaeis guineënsis*.

NOYES (W. M.). **Moth Pests in Cocoa and Confectionery.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 77–121, 37 refs. London, March 1930.

An extended account is given of the bionomics and control of the chief pests of cacao beans and chocolate in British factories, namely, the Pyralids, *Ephestia kühniella*, Zell., *E. elutella*, Hb., *E. cautella*, Wlk., and *Plodia interpunctella*, Hb., of which the life-history and habits are all similar [*cf. R.A.E.*, A, xvii, 175, etc.]. The last named is more commonly found attacking various nuts, but will also thrive on cacao beans. *Corcyra cephalonica*, Staint., is a minor pest of cacao beans.

E. elutella is by far the most common. There is at least one generation a year, and possibly two, except in cool stores and warehouses. The eggs, of which one female may deposit 100–250, are frequently pushed through the meshes of a sack and deposited on a crevice on the cacao bean, but never inside the shell of the bean, which the ovipositor cannot pierce. At normal temperature the eggs hatch in from 7 to 14 days, and the young larva crawls through the crack of a bean (if it fails to find one it generally dies of starvation) and begins to feed inside a silken tube, in which it remains until full-grown, and from which it emerges to pupate in a suitable crevice. The larval period generally lasts for 10–22 weeks and the pupal stage about 11–16 days at room temperature.

A large range of stored products is attacked by these moths. The various methods of control that have been recommended are reviewed, and many experiments are described that have been undertaken to test the control measures and also to determine the survival of pests during manufacture. Beans frequently arrive infested at the factory, and to obviate this condition, treatment must be given at the docks, either by heat or fumigation. Within factories, it was found that no insect life can survive any part of the process of the manufacture of chocolate; eggs and all stages are killed by roasting or by being covered with melted chocolate, and experiments indicate that the propagation of moths in airtight boxes and tins of chocolate will not extend beyond one generation, though probably in cardboard packages the penetration of air would be the determining factor. General measures at present recommended for factories are cleanliness throughout, avoidance of spaces that would encourage breeding and pupation, removal of all waste material, and frequent sweeping, white-washing, etc. Beans subjected to 140–149° F. for an appreciable time (depending on the quantity treated and only ascertainable by experience) are cleared of all infestation, and another worker has found that the cocoa is not damaged if the temperature does not exceed 160° F. Storage must be in such manner that re-infestation cannot occur, *e.g.*, with the protection of a fine-mesh material. Traps succeed in capturing a good many stray moths, especially when placed in light places such as near windows. Of a number of substances tried as traps, the best results were obtained with vinegar and fermenting fruit syrup in the proportion of 1 : 3. It is not considered probable that the moths can be exterminated by means of their parasites [*loc. cit.*].

MILLER (D.). **Insects infesting** *Phormium*.—*N. Z. J. Sci. Tech.*, xi, no. 5, pp. 273–283, 5 figs., 8 refs. Wellington, N.Z., February 1930.

This paper is largely a revision of information previously noticed [*R.A.E.*, A, iv, 431; vii, 82, etc.] and deals chiefly with the life-

history and control of the Geometrid, *Orthoclydon praefectata*, Wlk., the chief of the flax grubs of New Zealand, and the Noctuid, *Persectania* (*Melanchra*) *steropastis*, Meyr. The former flies at night and shelters during the day among dense foliage. The eggs are deposited in batches of from 1 to 90 on the back of the leaf, an average of 200 being laid by each female. The young larvae immediately attack the leaves, and it is possible to tell the approximate age of the larva by the size and freshness of the cuts made in them. The larvae are nocturnal in habit and shelter in dead leaf-tubes during the day. When immersed in water, they perish in about 10 minutes. The insects that help to control both these species are *Ichneumon* sp., *Paniscus productus*, Brullé, *Phorocera marginata*, Hutt., and *Syrphus ropalus*, Wlk. *P. productus*, which parasitises the larva of *P. praefectata*, does not destroy its host until after pupation, so that the injury to flax is not affected by it. It is suggested that further study should be made of the insect population of *Phormium* and of such exotic insect enemies as might be imported and established for their control.

Short notes are given on other insects attacking *Phormium*, which are not considered of economic importance ; these include species inhabiting the gum fluid [*R.A.E.*, A, ix, 179].

Gourlay (E. S.). **Some Parasitic Hymenoptera of Economic Importance in New Zealand.**—*N.Z. J. Sci. Tech.*, xi, no. 5, pp. 339–343, 2 figs., 5 refs. Wellington, N.Z., February 1930.

The species dealt with include the Braconid, *Diaeretus rapae*, Curt., the only primary parasite known in New Zealand of the cabbage aphis, *Brevicoryne brassicae*, L., which is a serious pest of the important cabbage crop ; it is itself parasitised by the Cynipid, *Xystus brassicae*, Ashm., and the Ceraphronid, *Lygocerus niger*, How. By the end of November the Aphids are well established on crops, but the parasite does not appreciably check their numbers until January, and its power is again lessened later on, as the two hyperparasites increase in numbers. The beetle, *Coccinella undecimpunctata*, L., introduced from Europe, and useful as a predator of Aphids, is parasitised in the adult stage by the Braconid, *Dinocampus coccinellae*, Schr., and is able to feed and appear normal until shortly before the emergence of the parasite larva, but does not seem able to free itself from the parasite cocoon. *Microterys flavus*, How., and *Metaphycus claviger*, Timb., are parasites of the soft scale, *Coccus hesperidum*, L., which feeds on *Citrus* and a number of other food-plants ; several individuals of either of these parasites may develop in one scale, and it was observed that the greatest number of adult males emerged from the smallest scales. Adults of *M. flavus* are present from December to May, and have been found at an altitude of 3,000 ft.

A pest evidently recently imported in seed of the Douglas fir (*Pseudotsuga*) is the Chalcidoid, *Megastigmus spermotrophus*, Wachtl, which oviposits in the seed when the cones are small and green, in September or October, the larva consuming the contents of the seed and remaining in it until the following spring, when it pupates and shortly afterwards emerges as an adult. The Psyllid, *Rhinocola eucalypti*, Mask., is a minor pest of *Eucalyptus globulus*, sucking the sap from the young shoots and causing malformation and arrested growth ; by midsummer the numbers are reduced by the Eulophid, *Pteroptrix maskelli*, Ashm., which parasitises the young larvae and

emerges from the full-grown ones. This parasite has several generations in a season, the last beginning in late autumn and the larvae remaining within the dead body of the host until the following spring, when pupation occurs. The Coccid, *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.) is heavily parasitised by the Chalcidoid, *Eucomys* (*Encyrtus*) *infelix*, Embleton. The Tortricids, *Tortrix postvittana*, Wlk., and *T. excessana*, Wlk., the former ovipositing on oak foliage, are parasitised by *Trichogramma minutum*, Riley. One parasite occupies each egg in an egg-mass, very few of them escaping parasitism. The Proctotrupoid, *Aphanomerus pusillus*, Perk., similarly attacks the egg-masses of *Siphanta acuta*, Wlk.

POWELL (T. N.). **Codling Moth Bandage Clip.**—*Agric. Gaz. N.S.W.*, xli, pt. 3, pp. 234–236, 4 figs. Sydney, 1st March 1930.

A wire clip is described which simplifies the operation of removing from trees and re-setting the trap bandages used for the control of the codling moth [*Cydia pomonella*, L.], and does away with the need for nails, wire or string. The method of making the clip and fixing it to the bandage is described and illustrated.

BUCKELL (E. R.). **The Apple Curculio as a Pear Pest in British Columbia.**—*Canad. Ent.*, lxii, no. 3, pp. 47–49, 1 ref. Orillia, Ont., March 1930.

In British Columbia, *Tachypterellus quadrigibbus*, Say (apple curculio) commonly occurs on hawthorn only, but since the summer of 1927 an infestation of pears has been reported from the Salmon Arm district ; this is unusual, as wild crab apples do not grow in that section and hawthorns are rare. The eggs, larvae and adults of the pest are very briefly described, and short notes on the bionomics of this weevil and its control are given [*R.A.E.*, A, xv, 47].

Notification, no. 1213—Agri.—*Govt. India Dept. Educ. Hlth. & Lds.*, 2 pp., multigraph. Simla, 27th May 1930.

By this amendment to a previous order [*R.A.E.*, A, xi, 38], cotton seed may not be imported into India by sea, except for experimental purposes, and then at Bombay only. The amount of a consignment must not exceed 1 cwt., and it must be fumigated on importation with carbon bisulphide, unless certified to have been so treated in the country of origin.

D'EMMEREZ DE CHARMOY (D.).—**Reports on the Operations for the Control of *Phytalus smithi* (Arrow) during the seasons 1926-27, 1927-28, 1928-29.**—Fol., 13, 10 & 6 pp. Mauritius, 1927–29. [Recd. 1930.]

In the course of the period covered by these reports, infestations of *Lachnosterna* (*Phytalus*) *smithi*, Arrow, on sugar-cane were discovered in several new areas in Mauritius. The numbers of beetles captured increased from 117 millions in 1926–27 to 252 millions in 1928–29.

In all, 9,578 individuals of both sexes of the Scoliid, *Tiphia parallela*, Smith, were liberated during the 3 years under review for

controlling this pest. There is evidence that this parasite has finally become established, since a survey conducted in 1927, months after its liberation, proved that its numbers had considerably increased. In experiments with calcium cyanide to control the larvae attacking full-grown and half-grown canes, very poor results were obtained, probably because the texture of the soil prevented the diffusion of the gas, and further tests with it were made on young cane. It was found that 10 grams of calcium cyanide to each stool killed 90 per cent. of the larvae after 24 hours, whilst 8 and 5 grams destroyed 77 and 50 per cent., respectively. When dry sand was mixed with the calcium cyanide in order to obtain a more bulky substance that could be applied more uniformly, with a 5-gram dose the mortality was 73 per cent. Experiments reported upon by W. H. Edwards show that calcium cyanide dissolved in water, to be effective in fields of ratoon canes, has to be applied when the soil is dry and absorbs water freely. On young canes it is just as effective when dry as when applied in water.

Greenhowe (G. E.). **Carrot growing in Gardens and Allotments, with special Reference to the Control of Carrot Fly.**—*Scot. J. Agric.*, xiii, no. 2, pp. 178–184, 2 pls. Edinburgh, April 1930.

The first part of this paper contains recommendations for better cultivation of carrots, such as the type of soil to be chosen, rotation, tillage, manuring, thinning, etc., in order to produce a satisfactory crop and prevent the attacks of *Psila rosae*, F. (carrot fly), which causes much damage all over the British Isles.

The second part is a brief account of the life-history and habits of the fly [*cf. R.A.E.*, A, x, 49, 105]. The symptoms of attack are discussed, and it is pointed out that once the fly has been allowed to deposit its eggs amongst the carrot plants, nothing can be done to save the crop; control must, therefore, depend solely upon preventive treatment. Practical experience showed that *P. rosae* is attracted to carrots only by its sense of smell; carrots grown together with onions in the same drill remained immune, the obvious explanation being that the odour of the onions prevents the pest from locating the carrots. Widely employed measures to protect the crop from infestation include early and late sowing, transplanting, the application of paraffin, tar oil, crude carbolic acid, etc. Crude or flake naphthalene should be sown broadcast over the carrot bed, when the seedlings are well above ground, about the end of May or beginning of June, at the rate of 1 lb. to 40 sq. yards, further applications being given at the same rate at seven-days intervals till the end of June, when three further applications might be given at ten-days intervals. This measure is inexpensive, simple and most effective.

Weber (H.). **Biologie der Hemipteren.**—*Biol. Studienbücher*, xi, vii+543 pp., 329 figs., 14 pp. refs. Berlin, Julius Springer, 1930. Price, paper *M.* 44, cloth *M.* 45.60.

This volume represents an attempt to supply a comprehensive account of the natural history of the Rhynchota, stress being laid on problems of general importance. The various sections deal with movement and senses, metabolism (the chapter on food including two

pages on the blood-sucking Rhynchota), reproduction and development, variation in abundance, ecology and biocoenosis. There is an index to the genera of the insects and to the plants mentioned, and also a subject index.

Hahmann (C.). **Weichkäferlarven als Schädiger im Gewächshaus.** [Telephorid Larvae as Pests in the Greenhouse.].—*Z. PflKrankh.*, xl, no. 3, pp. 117–124, 4 figs., 7 refs. Stuttgart, March 1930.

Telephorid beetles and their larvae are known to be predacious on other insects, but some species cause injury to plants, records of which are reviewed from the literature. Larvae of *Telephorus* sp. attacked the flowers of *Chrysanthemum indicum* in November 1929 near Hamburg, in a greenhouse. They were very numerous at night, attacking the petals without injuring any other part of the flowers. As chrysanthemum plants are very sensitive to calcium cyanide, the use of nicotine in the evening or early morning is suggested, but the most effective measure is shaking the insects off in the evening and morning.

Kästner (A.). **Untersuchungen zur Lebensweise und Bekämpfung der Zwiebelfliege** (*Hylemyia antiqua,* **Meigen). iv. Teil (Schluss). Generationenfolge und Köderversuche, 1929.** [Investigations on the Biology and Control of the Onion Fly. Part iv (Conclusion). The Sequence of Generations and Bait-experiments in 1929.]—*Z. PflKrankh.*, xl, no. 3, pp. 124–137, 7 refs. Stuttgart, March 1930.

This is an additional paper of a series already noticed [*R.A.E.*, A, xviii, 2]. Weather has a great influence on the date of appearance of the onion fly, *Hylemyia antiqua*, Mg., and on its length of life. One week of cool, rainy weather during the main flight-period not only prolongs the life of the flies, but also delays oviposition and affects the date of the appearance of the following generation. The results of bait experiments showed that the onion bait poisoned with sodium fluoride [xvii, 460] reduced the numbers of the flies to a point where the injury was negligible. The attraction is so great that the number of flies that settle on isolated baits gives a fair indication of the amount of danger threatening the field. On cool days the abundance of dead flies proves the effectiveness of the poison. The sodium fluoride acts slowly, thus permitting some injury to occur; sodium arsenite might be more suitable. The onion bait is more effective than a liquid poison in jars.

Löhle (M.). **Beobachtungen über Aenderungen im Habitus an von Fritfliegen befallenen Maispflanzen.** [Observations on Changes in the Condition of Maize Plants attacked by the Fruit Fly.]—*Z. PflKrankh.*, xl, no. 3, pp. 137–143, 6 figs. Stuttgart, March 1930.

Maize plants grown in pots at Breslau in the summer of 1929 were found to be infested by larvae and pupae of *Oscinella frit*, L. The symptoms caused are described.

Stahl (A.). **Amaryllis-Schädlinge.** [Pests of *Amaryllis*.]—*Möllers deuts. Gärtner-Ztg.*, xliii, p. 26, 1928. (Abstract in *Z. PflKrankh.*, xl, no. 4, p. 203. Stuttgart, April 1930.)

Amaryllis bulbs in Wurtemberg were found to be infested by *Merodon equestris*, F., a Syrphid that has been introduced from southern Europe into greenhouses in Germany, and *Eumerus strigatus*, Fall., which is indigenous, but has not been recorded before from this plant.

Popovič (J.). **Ergebnisse der Versuche mit einigen chemischen Präparaten zur Bekämpfung der gemeinen Schildlaus** (*Lecanium corni*) **auf Zwetschgenkulturen in Bosnien.** [Results of Experiments with some chemical Preparations for combating *L. corni* on Plum Trees in Bosnia.]—*Rad fitopatol. Zavod. u Sarajevu*, p. 24, 1 fig., 1 map, 1928. (In Serbian with German Summary.) (Abstract in *Z. PflKrankh.*, xl, no. 4, p. 207. Stuttgart, April 1930.)

In Bosnia, *Lecanium corni*, Bch., is rarely found above 2,000 ft., or in sunny situations, but does severe injury in shady places, especially deep valleys. Young larvae occur from mid-May to the end of June; they are found on the leaves up to November. The branches and trunks then become infested, and hibernation takes place on them. Of the remedies tested, barium polysulphide, 4–5 per cent., and carbolineum, 10 per cent., gave good results.

Friederichs (K.). **Noch einiges über die Ursachen stärkeren oder schwächeren Auftretens von Insektenarten.** [A few Words more on the Causes of the greater or less Abundance of Insect Species.]—*Anz. Schädlingsk.*, vi, no. 3, pp. 25–26. Berlin, 15th March 1930.

Discussing Reh's article [*R.A.E.*, A, xviii, 293], it is pointed out that though weather undoubtedly governs the occurrence of a pest over large areas, in individual localities local conditions are of more importance, and that these can sometimes be modified in protective measures against insects.

Gante (T.). *Brotolomia meticulosa*, **L. als Schädling an Gartenerdbeerpflanzen.** [*B. meticulosa* as a Pest of Garden Strawberry Plants.]—*Anz. Schädlingsk.*, vi, no. 3, p. 34. Berlin, 15th March 1930.

The caterpillars of *Brotolomia meticulosa*, L., are recorded as eating the leaves of strawberry at Geisenheim, Germany, in the late autumn of 1928.

Zolk (K.). [The Control of the Mustard Leaf Beetle, *Phaedon cochleariae*, F., by Means of Arsenical Dusts.]—*Agronomia*, 1929. (Abstract in *Anz. Schädlingsk.*, vi, no. 3, pp. 34–35. Berlin, 15th March 1930.)

In 1925, experiments were made with calcium arsenate dust against *Phaedon cochleariae*, F., which is a serious pest of turnips and other crucifers, in Estonia [*cf. R.A.E.*, A, xvii, 681], and further experiments

in 1926 confirmed the value of this insecticide, which is now in general use. A list of various proprietary forms of it is given, with notes on the results with some of them. Dusting is best done on a quiet night with some dew. The "Puhuri" duster [xvi, 594] proved superior to all others.

STELLWAAG (F.). **Giftigkeit und Giftwert der Insektizide. II. Teil. Allgemeine Technik der physiologischen Wertbestimmung.** [Toxicity and toxic Value of Insecticides. Part II. The general Technique of Determination of physiological Value.]—*Anz. Schädlingsk.*, vi, no. 4, pp. 37–42. Berlin, 15th April 1930.

This further paper [*cf. R.A.E.*, A, xvii, 685] discusses the physiological determination of insecticidal values, since chemical analysis alone does not give reliable information on this property of a substance. Large-scale experiments to ascertain the practical value of an insecticide are costly and protracted, nor can all possible errors be entirely eliminated. Plot-experiments for the purpose of testing the suitability of materials enable comparisons to be made, but necessarily supply data only as regards the conditions actually obtaining at the time. Laboratory tests to find comparative toxicity values require uniform conditions. Individual tests aim at ascertaining the reaction of the insect concerned and the toxicity to it of a given insecticide, 1 gram of body-weight being the standard of reference. Hitherto these four classes of tests have not been clearly separated, and although much research has been done on insecticides, there does not exist as yet a fully-developed pharmacology of these substances.

VON WINNING (E.). **Reifefrass von rindenbrütenden Borkenkäfern (Ipiden) an Blättern.** [Maturation Feeding on Leaves by Bark-beetles breeding in Bark.]—*Anz. Schädlingsk.*, vi, no. 4, pp. 42–45, 5 figs. Berlin, 15th April 1930.

Loganius vismiae, Egg., is recorded as feeding on the leaves of *Vismia lauriformis* in Costa Rica, and *Camptocerus aeneipennis*, F., on an unidentified plant in Panama.

THOMANN (H.). **Der Graue Lärchenwickler** (*Semasia diniana*, **Gn.**). [The grey Larch Tortrix, *Enarmonia diniana.*]—*Jber. naturf. Ges. Graubündens*, N.S., lxvii, pp. 3–46, 3 pls., 6 figs., 20 refs. Chur, 1929.

Enarmonia (*Semasia*) *diniana*, Gn., which is widely distributed in northern Europe and has been recorded from North America, is a serious pest of larch in the Engadine. Other conifers are also attacked. The adults fly at night, when oviposition probably takes place. The eggs are laid, generally singly, in the branches and twigs, under the bark scales or in cracks, or preferably under the lichen with which the upper side of old branches is covered. The larvae appear in May–June, and pupation occurs in cocoons, generally among the needles at the foot of the trees. The pupal stage lasts 17 or 18 days, complete development taking about 40. The adults are most numerous in the Engadine from mid-July to mid-August, though the author found larvae as late as 24th July. Notes are given on the life-history of some other moths found associated with this species on larch.

Predators of *E. diniana* are birds, bats and the red wood ant, *Formica rufa*, L. The following were found associated with this moth, and are all possibly parasites of it : *Phytodietus obscurus*, Desv., *Triclistus pallidipes*, Hol., *Eulimneria* (*Limnerium*) *turionum*, Ratz., *Angitia* (*Dioctes*) *exareolata*, Ratz., *Rhogas circumscriptus*, Nees, *Phaeogenes lascivus*, Wsm., *Leptocryptus claviger*, Tasch., *Plectocryptus arrogans*, Grav., and *Erromenus punctulatus*, Grav.

To supplement natural biological control, assisted, if necessary, by the introduction of parasites, dusting the trees with lead arsenate from aeroplanes should prove of value.

Prell (H.). **Der Graue Lärchenwickler** (*Enarmonia diniana* **Z.**) **als Grosschädling im Sächsischen Fichtenwald.** [The Grey Larch Tortrix, *E. diniana*, as a serious Pest in the Saxon Spruce Forests.]—*Tharandter forstl. Jahrb.*, lxxxi, no. 2, pp. 49–92, 2 pls. Berlin, 1930.

The Tortricid, *Enarmonia diniana*, Gn., which seriously injures larch in the Alps [see preceding paper], and pine in Denmark, has in the past been considered quite unimportant in Saxony. In the Alps, outbreaks usually occur about every 6–10 years. After one year of noticeable increase there usually follow two of heavy infestation, which suddenly dies down. In May 1924, an increase of *E. diniana* was observed in the spruce forests of Bohemia, and by 1929 the moth had spread to various points in Saxony covering an area of about 360 sq. miles, and had done serious injury in many places. Particulars of its biology, chiefly on spruce, were obtained. At the beginning of the warm season the larvae hatch from the hibernated eggs, usually about May, when the spruce buds are swelling, and feed on the young needles. The upper branches of old trees are the first to be attacked, and the infestation, if severe, may extend downward. Feeding occurs over a period of 6–8 weeks. The injury done by *E. diniana* may be easily mistaken for that by the small spruce sawfly, *Lygaeonematus pini*, Retz. The flight period usually begins in August and lasts until the end of September.

No specific parasites of *E. diniana* have been recorded. In 1929 there was, however, an extraordinary abundance of Hymenopterous parasites in the forests at Steinbach attacked by it, especially of two Ichneumonids, *Pimpla brevicornis*, Grav., and *P. turionellae*, L. This was not noticed elsewhere, but the parasites recorded in the Alps are polyphagous species maintained by the varied flora there and are likely to be absent from pure spruce areas in Saxony. The damage done by the larvae is not of great importance, unless it is often repeated.

Heymons (R.), Lengerken (H. von) & Bayer (M.). **Studien über die Lebenserscheinungen der Silphini (Coleopt.). VI.** *Blitophaga undata* **Müll.** [Studies on the Bionomics of Silphini (Coleopt.)]—*Z. Morph. Oekol. Tiere*, xviii, no. 1–2, pp. 170–188, 5 figs., 35 refs. Berlin, 24th May 1930.

Under experimental conditions, *Blitophaga undata*, Müll., lives on similar food to that of *B. opaca*, L. [*R.A.E.*, A, xvii, 326], the effect of an exclusively meat diet being the same. Its eggs, which are also laid in the soil, hatch after an average of 7·3 days, the average length

of the larval life being 35. Pupation takes place in the soil, the prepupal stage averaging 6·8 days, and the pupal stage 11·3, depending on the temperature. The young beetle remains in the pupal cell for about 2 days before making its way to the surface. After feeding for about 3 weeks, the beetles, at the end of June, or beginning of July, return to the soil, where they hibernate. The morphology of all stages is described.

Werth (E.) & others. **Krankheiten und Beschädigungen der Kulturpflanzen im Jahre 1926.** [Diseases and Injuries of Cultivated Plants in 1926 in Germany.]—*Mitt. biol. Reichsanst. Land- u. Forstw.*, no. 40, 159 pp. Berlin, March 1930.

Annotated lists of the insect pests recorded in Germany in 1926 are given, divided according to the class of crop.

Radulesco (E.). **Quelques observations biologiques sur** *Parthenothrips dracaenae* **Heeg. et** *Aptinothrips connaticornis* **Uzel.**—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 2, pp. 24–28. Paris, February 1930.

Observations made in Paris on *Parthenothrips dracaenae,* Heeg., a greenhouse species found on *Croton, Ficus, Dracaena* and *Tradescantia,* have shown that two races are present, one parthenogenetic and the other sexual, which develop simultaneously and under the same conditions in that region.

Aptinothrips connaticornis, Uzel, is a variety of *A. rufus,* Gmel., which is said to give rise to it under certain conditions of temperature and dryness. At Saint-Genis-Laval (Rhône) adults were found in early May on wild grasses and on wheat. The life-cycle requires from 25 to 27 days. Rearing was continued throughout the year, and larvae were constantly obtained from isolated unfertilised females, but some females disappeared without ovipositing, and it is thought that perhaps in this region there is a sexual race that has given rise to a parthenogenetic one and is itself in the course of dying out.

Petit (A.). **De l'action préservatrice des anticryptogamiques, spécialement des poudres cupriques vis à vis de certains insectes parasites des semences de froment.**—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 2, pp. 33–35. Paris, February 1930.

As seed-wheat in Tunisia and in many other countries is almost invariably treated with copper dusts as a protection against diseases, experiments were made to determine whether this treatment preserved the grain from the attacks of insects such as weevils, moths [*Sitotroga cerealella,* Oliv.], etc. It was found that copper salts, even when used in the pure state, cannot protect the grain for long periods. Even in a closed space they are only effective for a few months, and carbon bisulphide or salts of mercury are more effective and lasting.

Eckstein [K.]. **Douglasien von Heuschrecken beschädigt.** [Douglas Firs injured by Grasshoppers.]—*Anz. Schädlingsk.*, vi, no. 4, pp. 47–48, 2 figs. Berlin, 15th April 1930.

In a nursery of Douglas firs [*Pseudotsuga taxifolia*] in Brunswick the main shoots of the smaller plants and the side-shoots of the larger

ones were bitten through by *Omocestus* (*Stenobothrus*) *haemorrhoidalis*, Charp., *Pholidoptera cinerea*, L., and *Acrydium* (*Tettix*) *bipunctatum*, L.

Sprengel (L.). **Die Pflaumensägewespen,** *Hoplocampa minuta* **Christ und** *Hoplocampa flava* **L. (Hym. Tenthr.).**—*Z. angew. Ent.*, xvi, no. 1, pp. 1–86, 53 figs., 53 refs. Berlin, March 1930.

Brief notes are given on various papers published on plum sawflies, especially in Germany, where, particularly since 1926, *Hoplocampa fulvicornis*, Panz. (*minuta*, Christ) and *H. flava*, L., have been very injurious to plum, damson and greengage in the Bavarian Rhine Palatinate [*R.A.E.*, A, xvii, 634, etc.]. The food-plants, geographical distribution, methods of breeding and morphology and biology of all stages are described. The two species have a similar life-history, the females always predominating. The adults have an average life of 14–16 days. The ovipositor is pushed into the calyx of a half-open *Prunus* blossom, and a single egg is laid. On an average about 20–30 are laid one after another on various blossoms, usually 3–4 days after emergence. Incubation takes 4–14 days, according to the weather. The newly-hatched larva feeds in the ovary. Development occurs in the ovary and in unripe fruits and lasts about 28 days. During its life, the larva attacks about 4 uninjured fruits. There are 4 moults. The first and second instars feed on the pulp ; the third on the pulp and stone, and the fourth and fifth on the contents of the stone. The excreta remain inside the fruit. The mature larva drops to the ground with the last fruit infested, leaves it, and burrows to a depth of 4–6 ins. In 24 hours, it spins a brown cocoon in which it hibernates at a depth of 3–4 ins. In spring, another, white cocoon is spun, and the adult emerges a fortnight later. A few larvae and pupae are destroyed by Ichneumonid parasites and a bacterial disease.

The best measure appears to be spraying the young fruits with arsenicals about 8 days after the petals fall, *i.e.*, before the chief migration of the larvae. The effect of the spray is increased by the addition of nicotine. A second application should be made about 8 days later, directed against the older migratory larvae. *H. brevis*, Kl., appears to be only an occasional pest of *Prunus* spp.

The weevil, *Rhynchites cupreus*, L., does somewhat similar damage, the adults appearing at the time that the sawflies are on the wing. It is especially prevalent in shady situations, and also seriously infests cherries.

Jöhnssen (A.). **Beiträge zur Entwicklungs- und Ernährungsbiologie einheimischer Coccinelliden unter besonderer Berücksichtigung von** *Coccinella septempunctata* L. [Contributions on the Development and Feeding Habits of native German Coccinellids with particular Reference to *C. septempunctata*.]—*Z. angew. Ent.*, xvi, no. 7, pp. 87–158, 14 figs., 51 refs. Berlin, March 1930.

It is concluded from the investigations described in this paper that *Coccinella septempunctata*, L., and *Adalia bipunctata*, L., are of little economic importance as destroyers of Aphids in Germany.

FRIEDERICHS (K.) & STEINER (P.). **Ueber Nachwirkungen der Begiftung des Kiefernspanners.** [On the After-effects of Poisoning the Pine Moth.]—*Z. angew. Ent.*, xvi, no. 1, pp. 189–196, 1 fig., 4 refs., Berlin, March 1930.

The fact that the older larvae of the pine moth, *Bupalus piniarius*, L., are not always killed by arsenical dusts has led to several investigations of the after-effects of the poison ingested by them. It was found that both poisoned and unpoisoned larvae reached the pupal stage, but that three times as many of the latter produced adults. The pupae of poisoned larvae are noticeably smaller, the fertility of females from them being much impaired. Breeding experiments with eggs collected in stands dusted in the previous year showed that the resultant larvae produced 3·4 per cent. of pupae, as compared with 19 per cent. in the non-poisoned groups.

A single application of the poison does not seem to affect the parasites of this moth.

FRIEDERICHS (K.). **Zur Epidemiologie des Kiefernspanners.** [A Contribution to the Epidemiology of the Pine Moth.]—*Z. angew. Ent.*, xvi, no. 1, pp. 197–205, 10 refs. Berlin, March 1930.

Increases of insects in forests only become abnormal when unduly concentrated [*R.A.E.*, A, xvii, 133], as has occurred in Germany, where the destruction of conifers has become very serious. The origin and growth of outbreaks in stands of trees of a certain age is the chief fact on which the theory of natural regeneration [*loc. cit.*] is based.

The following statements relate to the pine moth, *Bupalus piniarius*, L., and to conditions in two areas in Mecklenburg, but are applicable to other pests elsewhere. In the first case (at Neukloster) the lower age limit for pine for severe attacks was about 28 years, and trees of medium age, *i.e.*, polewood, between 25 and 80 years may be regarded as preferred. The fact that young trees are not infested is not due to their unsuitability, for the larvae have been readily bred on quite young, 3-ft. trees of *Pinus sylvestris*. Nor is selection by the ovipositing females probable, especially as they have little mobility. It is the situation of a stand that matters, trees in high positions and sunny slopes being more exposed to attack, the distinction lying in what is rather vaguely termed " local climate."

It is therefore necessary to differentiate between (1) general meteorological conditions ; (2) the climate of a given locality ; and (3) the " climate " in a given habitat in the locality. For instance, pupation in a shaded hollow may well result in delayed emergence, which may affect the amount of injury. Evaporation is the most comprehensive expression of the conditions in (2) and (3), and this factor requires further investigation. The " climate " of a stand varies with the age of the trees and the resultant degree of thinning. This begins when the young trees grow to polewood size, and the sun warms the ground increasingly as the thinning progresses until a condition of warmth favourable to *B. piniarius* is reached. The tree-age and the corresponding degree of thinning evidently depend on the general climate governing rapidity of growth. In a cool climate the age-limit is shifted upwards, and, as a fact, young trees and the younger polewood suffer less than older trees in Mecklenburg-Schwerin, while in the

warmer region of Mecklenburg-Strelitz conditions are somewhat different. The nature of the ground and of the ground-litter also has its effect, for moss and humus store considerable quantities of water, and this results in great losses among the pupae, the onset of the danger period being thereby postponed. The above notes apply to unmixed pine forests, but in Mecklenburg the presence of 30-year-old beech trees suffices to protect pines from defoliation, even when small mixed stands are surrounded by extensive pine forests. If the "local climate" be the reason, or one of the reasons, it must be connected with the shade produced by the beeches. Spruce has the same effect. Infestation depends chiefly on the surviving larvae and not on the pupae and ovipositing adults. Temperature, moisture, and parasites are the factors involved here, but little is known of these in respect of *B. piniarius*. As a rule, weather causes a greater mortality than parasites, and it is doubtful whether the latter play a preponderant part.

It will probably be found that insect abundance is regulated by a close interplay of abiotic and biotic factors. Periods of non-infestation after outbreaks are doubtless due to weather, while limitation of infestation to certain areas is due to various local factors. The study of the many questions involved would be assisted by the creation of forest experiment stations. "Local climate" also deserves attention in the study of field and garden pests.

von Lengerken (H.). **Ueber die Artabgrenzung und Modifikabilität der Gemüsewanzen aus der Gattung** *Eurydema*, **Lap.** [Definition and Variability of the Species of Bugs of the Genus *Eurydema* attacking Vegetables.]—*Z. angew. Ent.*, xvi, no. 1, pp. 206–221, 11 figs., 35 refs. Berlin, March 1930.

This paper includes a key to the species of *Eurydema*, with brief notes, compiled from the literature, on their distribution, biology, food-plants and economic importance. Sprays of petroleum-soap, lysol, or nicotine and soap are generally recommended. Collection of the eggs is possible only in small gardens.

Jordan (K. H. C.). **Zerfressene Zigarren.** [Cigars attacked by *Tenebrio molitor*.]—*Mitt. Ges. Vorratsschutz*, vi, no. 2, p. 19. Berlin, March 1930.

Adults of the flour beetle, *Tenebrio molitor*, L., are recorded from Germany feeding in a box of cigars, into which the larvae had apparently penetrated through cracks, the presence of larval skins indicating that the larvae had also fed on the tobacco.

Zacher (F.). **Schädlinge an getrockneten Bananen.** [Pests in dried Bananas.]—*Mitt. Ges. Vorratsschutz*, vi, no. 2, pp. 19–21. Berlin, March 1930.

The larvae of *Plodia interpunctella*, Hb., and of the Bostrychid, *Apate monacha*, F., and all stages of the Cucujid, *Cathartus* (*Ahasverus*) *advena*, Wltl., are recorded from dried bananas imported into Germany, probably from Kamerun.

Scheel (G.). **Der Hausbock** *Hylotrupes bajulus*, **L.**=(*Callidium bajulum*).—*Mitt. Ges. Vorratsschutz*, vi, no. 2, pp. 21–25. Berlin, March 1930.

Records are given of infestations in buildings by the Cerambycid, *Hylotrupes bajulus*, L., in the Lahn region, Germany. Only coniferous timber is attacked. Cutting out infested portions and then applying carbolineum was the treatment adopted.

v. Lengerken (H.). **Speckkäfer in stark gesalzenen Schweinefleish.** [Bacon Beetles in highly salted Pork.]—*Mitt. Ges. Vorratsschutz*, vi, no. 3, pp. 30–31. Berlin, May 1930.

Dermestes lardarius, L., has been found feeding in the larval stage, pupating and emerging as normal adults, in very highly salted pork.

Moll (F.). **Käferfrass in Nutzholz.** [Beetle Injury in worked Wood.] —*Mitt. Ges. Vorratsschutz*, vi, no. 3, pp. 31–35. Berlin, May 1930.

A popular account is given of the boring beetles, *Anobium punctatum*, DeG. (*striatum*, Ol.), *Coelostethus* (*A.*) *pertinax*, L., *Xestobium rufovillosum*, DeG., *Ernobius mollis*, L., and *Ptilinus pectinicornis*, L., and of the damage done by them, chiefly to furniture.

Kalandadze (L.). **Die Vorrats- und Speicherschädlinge in Georgien, U.S.S.R.** [Stored Food and Warehouse Pests in Georgia.] —*Mitt. Ges. Vorratsschutz*, vi, no. 3, pp. 35–37. Berlin, May 1930.

Pests of stored products are of great importance in Georgia, *Calandra granaria*, L., *C. oryzae*, L., *Silvanus* (*Oryzaephilus*) *surinamensis*, L., *Sitotroga cerealella*, Ol., *Ephestia kühniella*, Zell., and *Plodia interpunctella*, Hb., being the most important. *C. granaria* is ubiquitous, but *C. oryzae* only occurs in the warmer southern parts of the country and never in the field.

Clothes and furs are attacked by *Tinea pellionella*, L., *Tineola bisselliella*, Hummel, and probably also by *Trichophaga tapetzella*, L. *Dermestes lardarius*, L., is a serious pest in the silk industry, destroying the cocoons of the silkworm [*Bombyx mori*, L.]. *Attagenus piceus*, Ol., *A. pellio*, L., *Trogoderma versicolor*, Creutz., and *T. nigrum*, Hbst., are other harmful species. *Anthrenus verbasci*, L., *A. museorum*, L., and *A. caucasicus*, Reitt., attack entomological collections.

Trappmann (W.). **Schädlingsbekämpfung im Gewächshaus.** [Measures against Pests in Greenhouses.]—*Flugbl. biol. Reichsanst. Land- u. Forstw.*, no. 104–108, 24 pp., 24 figs. Berlin, March 1930.

This circular discusses various preventive and remedial measures in general use against insect pests in greenhouses. Notes are given on the various insect pests concerned, grouped according to the part of the plant attacked, with details of the characteristic appearance of the damage done.

ROZSYPAL (J.). **Ein Beitrag zu der Vergesellschaftung und Ueberwinterungsmöglichkeit der Imagines bei den Chloropidaeen (Dipt., Chlorop.).** [A Contribution to the Knowledge of the Assemblage and Possibility of Hibernation of the Adults of Chloropids.] —*Z. wiss. InsektBiol.*, xxv, no. 1–2, pp. 1–13, 3 figs., 19 refs. Berlin, 30th April 1930.

Three cases of Chloropid flies assembling in masses in buildings are recorded, the wheat pest, *Chlorops taeniopus*, Mg., being concerned in one instance in autumn in Moravia.

OBRAZTSOV (N. S.). **Beitrag zur Biologie von** *Loxostege sticticalis* **L. (Lep., Pyr.).** [A Contribution to the Biology of *L. sticticalis.*] *Z. wiss. InsektBiol.*, xxv, no. 1–2, pp. 13–18, 6 figs. Berlin, 30th April 1930.

A description is given of the various types of injury to foliage done by the larvae of the Pyralid, *Loxostege sticticalis*, L., with a list of its food-plants observed near Nikolaev, Russia.

BARANOFF (N.). **Die wahre** [the true] *Ceromasia senilis* **Mg. und** *juvenilis* **Girschn. (Dipt. Tachin.).**—*Konowia*, ix, no. 1, pp. 34–36. Vienna, 1930.

It is stated that the Tachinid of the genus *Ceromasia* bred from *Pyrausta nubilalis*, Hb. [*cf. R.A.E.*, A, xvii, 215 ; xviii, 151, etc.] is not *C. senilis*, Mg., as usually believed, but *C. juvenilis*, Girschn., 1899 (nec Rnd., nec B.B., nec Bezzi, nec Baer).

LE PELLEY (R. H.). **New Pest attacks Coffee Trees.**—*E. African Standard*, Nairobi, 2nd May 1930.

A brief description is given of a bug [*Lygus simonyi*, Reut.] that feeds on the flowers, buds and other tender parts of coffee in Kenya Colony. It is generally present in small numbers, but on some estates as many as 190 have been taken from one tree. On these estates various proportions of the blossoms have failed to set, though how far this is directly due to the bug has not yet been ascertained.

LIGHT (S. S.). *Helopeltis* **in Ceylon.**—*Tea Quarterly, J. Tea Res. Inst. Ceylon*, iii, pt. 1, pp. 21–26. Nuwara Eliya, February 1930.

Recent enquiries on the present distribution in Ceylon of *Holopeltis antonii*, Sign., which some 30 years ago used to be an important pest of tea in several districts, indicated that this Capsid has become considerably reduced in recent years, only two districts being now still affected to an extent that calls for attention. The adults and nymphs, which are briefly described, feed at night, and only on the young shoots, and during the day conceal themselves low down in the centre of the bush. The feeding punctures leave a series of spots, and finally the leaves crumple up and often turn black. As a result, the yield from infested bushes for several weeks may drop by over 50 per cent. Outbreaks are most severe in July-September, the dry, windy weather of that season being particularly favourable to the

development of the Capsid; minor attacks occur in December-February. The eggs are laid singly or in groups of two or three, embedded in the tissues of the young stems. The bushes are attacked usually at nine months to one year from pruning, serious defoliation being caused only to those in very poor condition. Better cultivation and manuring of the fields are, therefore, likely to be more effective than any other method of control.

Since windy weather favours the pest, wind belts might afford some protection, but such belts sometimes harbour insects that are driven into them by the wind. Shade trees are of little benefit; heavy shade even definitely encourages *H. antonii.* Although pruning has the effect of checking the insect for 9–12 months, it should be used in very severe cases only. As the eggs are laid in the stems of the flush, and the insects feed on the young leaves only, hard and repeated plucking may safeguard the bush from severe infestation. Hand collection might be assisted by the use of sticky screens placed beneath the bushes.

No parasites of *H. antonii* have as yet been discovered in Ceylon, and it is probable that they are not a factor of importance in controlling it.

Other bugs occasionally found feeding on tea in Ceylon, particularly species of *Disphinctus,* and possibly *Callicratides rama,* Kirby, cause injury very similar to that due to *H. antonii.* *C. rama* is frequently found in considerable numbers. The information given on its bionomics has already been noticed [*R.A.E.*, A, xvii, 172].

CLEARE, jr. (L. D.). **The Tannia Beetle,** *Ligyrus ebenus,* **DeG.**—*Agric. J. Br. Guiana,* iii, no. 1, pp. 11–23, 4 pls. Reprinted as *Ent. Bull. Dept. Agric. Br. Guiana,* no. 1, pp. 11–23, 4 pls. Georgetown, March 1930.

The Dynastid beetle, *Ligyrus ebenus,* DeG., has been for many years an important pest of tannias (*Xanthosoma* sp.) in the north-west of British Guiana [*R.A.E.*, A, xvi, 112], where this crop is very valuable in connection with the establishment of coffee cultivation. The economic history of the pest is briefly reviewed, and the habits of the adults and larvae, as well as the nature of injury caused by them, are discussed. All stages are described. The entire life-cycle of the insect occupies about a year, and almost the whole of its life is spent below ground. The adult beetles are strongly attracted to humus and decaying vegetable matter, the females depositing their eggs in such substances, and the larvae feeding on them and the rootlets of succulent plants. The adults emerge from April to July, being usually most abundant in May and June, but after emergence they may remain in the ground until the beginning of the wet season, when they appear in the fields. By the end of July, a large number of beetles die, while others burrow into the ground and continue to live below the surface for several months. They attack the crop either by boring into the growing plants and shoots from above or below, or by feeding directly on the sets below ground and tubers, and inflict serious damage in both cases. Oviposition begins in October-November, the eggs being laid singly a few inches below the surface of the ground wherever conditions of moisture are suitable. The egg stage lasts 9–15 days, a certain minimum degree of moisture of the soil being apparently essential for development. The larvae require about 11 weeks to

reach maturity, and become active in March of the following year; full-grown individuals may be found up to June. They eat into the tannia tubers shortly before the crop is ready for reaping, and may do serious injury. If early planting is carried out, the sets may be injured by this same group of larvae prior to pupation. In order to avoid this, the planting, which should normally take place in May, is usually delayed until about July. Pupation occurs from March to July, the pupal stage lasting about 9–16 days.

There appears to be a periodicity in the outbreaks of *L. ebenus* of about 9 years, which show some correlation with meteorological conditions. The larvae, especially the young ones, are very susceptible to even small excesses of moisture; the rains at the end of the year exert a decided and important check on the increase of this beetle, and outbreaks may occur in years in which the rainfall at this time is below normal.

Little is known about its natural enemies. In the laboratory the eggs were severely attacked by predacious mites, while the larvae were found to be occasionally preyed upon by those of an Elaterid beetle. The fungus, *Metarrhizium anisopliae*, may cause a high mortality amongst the larvae, pupae and adults.

The control measures recommended are late planting, treatment of the cut surfaces of the sets with hot tar prior to planting, the removal of all rotting tannias and other decaying vegetable matter from the fields and, if possible, the introduction of pigs. The yellow variety of tannia appears to be attacked in preference to the white. A short flooding of about 10 hours given to the fields after the tannia crop has been removed will completely destroy both larvae and pupae. A caustic solution, 1 gal. to 360 gals. water, applied to moist soil by means of spraying machines, or even with an ordinary watering can, at the rate of 2 pints per sq. ft., might be effective. The formula recommended is 5¼ lb. commercial caustic soda, 1 gal. cresol fluid (Rideal Walker carbolic co-efficient 18–20), 10 lb. washing soda, and 5½ gals. water; the caustic soda is first dissolved in the water and the other ingredients added in the order given. Further experiments with this insecticide are, however, required.

The larvae and pupae of *Dyscinetus geminatus*, F., *Gymnetis maculosa*, Oliv., and *Phileurus didymus*, L., which also occur in north-western British Guiana, may be confused with those of *L. ebenus*. The mature larvae of *P. didymus* are, however, very much larger.

CLEARE, jr. (L. D.). **The Destruction of Coushi Ants with Carbon Bisulphide.**—*Agric. J. Br. Guiana*, iii, no. 1, pp. 24–27. Georgetown, March 1930.

Atta cephalotes, L., is the commonest and most destructive of the leaf-cutting ants in the coastal area in British Guiana. Its habits and nest are briefly described. Previous to the destruction of the nest, all weeds and growth about it should be removed; all the exit holes should thoroughly be plugged with wet clods of earth, with the exception of one or two, down which about 2 fl. oz. of carbon bisulphide are poured and the holes closed lightly for a few minutes; they are then uncovered and a lighted torch, tied to a long stick, is applied to their mouths. The largest nests may thus be destroyed, usually in one operation.

Other species occurring in British Guiana are *Acromyrmex octospina*, Reich., and *Atta laevigata*, Sm., which attack crops in areas in proximity to forests. Their nests are smaller and usually somewhat inaccessible, being built under or within logs, under large stones or in hollows in the wooden pillars supporting houses. They may be destroyed, however, by introducing carbon bisulphide directly into the nest by means of an oil-can, and then closing it tightly with earth.

FLETCHER (T. B.). **Report of the Imperial Entomologist.**—*Sci. Rep. Agric. Res. Inst. Pusa, 1928–29*, pp. 67–77, 4 pls., 1 ref. Calcutta, 1930.

Regular examination of cultivated and wild sugar-cane revealed no new borers [*R.A.E.*, A, xvi, 357]. The first eggs of *Scirpophaga nivella*, F., were laid on the newly-planted cane by the middle of April, whereas previously they were deposited on ratoon canes only. Investigations on the Aleurodid, *Neomaskellia bergi*, Sign., as a transmitter of mosaic disease in cane have given negative results. Other sugar-cane pests were the grasshopper, *Hieroglyphus banian*, F., and *Aphis sacchari*, Zehnt. *Saccharum spontaneum* was attacked by the Cossid, *Phragmatoecia purpureus*, Fletcher.

Rice was infested in one locality by *Hispa armigera*, Ol., and the Gelechiid, *Brachmia arotraea*, Meyr., was reared from caterpillars found on rice at Pusa.

Pempheres affinis, Fst., occurred in cotton-stems at Pusa, and larvae of *Platyedra gossypiella*, Saund., were found feeding on seeds of *Hibiscus abelmoschus*. Notes on the bionomics of the Braconid, *Dinocampus mylloceri*, Wilkn. [xvii, 656], parasitic on the adults of the weevil, *Myllocerus undecimpustulatus* var. *maculosus*, Desb., are given. The behaviour of the female parasite when pursuing the host is described ; in captivity the same individual may oviposit several times in one weevil, and as many as five and eight eggs, respectively, were found in two weevils ; they do not all of them develop, however, and only one Braconid larva seems to attain maturity ; the different instars are briefly described. At Pusa, *D. mylloceri* occurs from the middle of November to the beginning of April.

Fruit pests included the Cerambycid, *Rhytidodera bowringi*, White, which was reported as damaging mango trees in the Purneah District, the older trees and thicker branches being preferred. Infestation is very difficult to detect, since the bored branches continue to look healthy, bear green leaves and throw out side-shoots, until they die back and drop off the tree. The eggs of *R. bowringi* are probably laid on the tips of the branches, and the larvae on hatching bore right down their centre, making a clear circular gallery; pupation takes place in the gallery, and young beetles appear in the first half of May, probably emerging through the tips of the branches. The larvae of a Eurytomid were responsible for a heavy loss in the apricot crop ; they live inside the kernel and cause the fruits to fall prematurely. The Aphid, *Myzus persicae*, Sulz., which caused leaf-curl on peaches, was effectively controlled by a spray of $\frac{1}{4}$ lb. powdered soap-nut (fruits of *Sapindus mukorossi*) in 2 gals. of water, in which $\frac{1}{2}$ lb. soap was dissolved. *Ceroplastes floridensis*, Comst., was very numerous on guava during December. The larvae of the Sphingids, *Theretra alecto*, L., and *T. clotho*, Drury, damaged the leaves of vines, sometimes causing

severe injury. The characters distinguishing them are briefly described and illustrated.

In studies of alternative food-plants of some common insects, small numbers of the larvae of *Diacrisia obliqua*, Wlk., were found on sweet-potato leaves, velvet beans [*Stizolobium*] and *Cajanus*; those of *Cryptophlebia* (*Agyroploce*) *illepida*, Butl., occurred in pods of *Bauhinia purpurea*; and the Cetoniid, *Epicometis squalida*, L., was abundant on peach, pear and apple trees, causing considerable damage to the blossoms. The larvae of *Acrocercops austeropa*, Meyr., infested the flowers of *Bauhinia purpurea*, and pupated on the leaves. Those of *Stomopteryx subsecivella*, Zeller, which is a common pest of ground-nut [*Arachis hypogaea*]in southern India, were found mining leaves of *Psoralea corylifolia*. Larvae of *Margaronia caesalis*, Wlk., were found boring in the shoots and buds of *Artocarpus integrifolia*.

Perigea capensis, Guen., attacked safflower [*Carthamus tinctorius*], on which it has not been noticed for several years past. The adults of *Agrilus grisator*, Kerr., emerged from infested *Citrus* stems during December and January.

A rare fruit-fly, *Mellesis eumenoides*, Bezzi, was reared in November from fruits of *Oxystelma esculentum* at Pusa; the adults proved to be long-lived, and passed the cold weather in this stage. Young leaves of *Dalbergia sissu* at Pusa were infested by *Leucoptera sphenograpta*, Meyr., which was abundant in September and December 1928 and March 1929.

Other Microlepidoptera recorded during the year include: *Microcolona leucosticta*, Meyr., in fruits of *Psidium*; *M. technographa*, Meyr., in shoots of guava; *Heterotactis quincuncialis*, Meyr., on leaves of *Acacia catechu*; *Lithocolletis epichares*, Meyr., on apples; *Acrocercops hormista*, Meyr., mining leaves of *Cedrela toona*; and *Bucolarcha geodes*, Meyr., in pods of *Acacia catechu*.

The information given on the preservation of stored food-grains from the attacks of insect pests by using small quantities of mercury, has already been noticed [xviii, 29]. The programme of work for 1929–30 is briefly outlined.

RAMACHANDRA RAO (Y.). **The Mango Hopper Problem in South India.**—*Agric. J. India*, xxv, pt. 1, pp. 17–25. Calcutta, January 1930.

The three species of Jassids of the genus *Idiocerus*, known as mango hoppers, which attack mango in South India, are: *I. atkinsoni*, Leth., *I. niveosparsus*, Leth. and *I. clypealis* Leth. While in some places all three may be found together on the same tree, their relative proportions may vary according to the locality and character of the season. The bulk of the injury appears to be caused by *I. niveosparsus*. The adults become active as soon as the flower buds start to form, and egg-laying then begins. The eggs, which are laid in the tissues of the inflorescence, hatch in 4–7 days. The nymphal period lasts 8–10 days, and the complete life cycle 12–17 days. Egg-laying is often greatly increased when the temperature drops to about 55–60°F. In some years two or more broods may occur during the blossoming period of the mango under favourable climatic conditions. The crop is damaged firstly by oviposition, and secondly by the immature stages, which crowd together among the florets, pierce the tissues of the flower panicles and drain their sap. In

severe cases the amount of honey-dew exuded by the hoppers is so great that even the inflorescences are completely covered, and rendered incapable of setting fruit.

A spray of 1 lb. fish-oil resin soap to 10 gals. water will effectively control the nymphs and should be thoroughly applied to the inflorescence when they begin to appear. The application should be repeated at intervals of a week if further hatchings are noticed.

BEAUMONT (C. H.). **Scale Insects of Citrus and their Control by Fumigation.**—*J. Dept. Agric. S. Australia*, xxxiii, no. 7, pp. 618–624. Adelaide, 15th February 1930.

A brief account is given of the bionomics of the chief Coccids attacking *Citrus* in South Australia, namely, *Chrysomphalus aurantii*, Mask., and *Saissetia oleae*, Bern., of which the latter is found to a large extent on weeds such as *Solanum nigrum*, and the former on roses. The successful methods of control are reviewed, including spraying with white or red oil emulsions and fumigation. It is estimated that although perfect fumigation under orchard conditions is impossible, 95 per cent. mortality may be obtained on *Citrus* by careful operation, which is described in detail. *Aphelinus diaspidis*, How., which is a parasite of *C. aurantii*, is said to be present in South Australia as well as Western Australia, and it is thought that it might be advantageous to undertake the propagation and dissemination of this Eulophid.

SHEAR (E. V.). **Washing Fruit to remove Spray Residue in the Hudson Valley.**—*Bull. New York Agric. Expt. Sta.*, no. 575, 34 pp., 14 refs. Geneva, N.Y., October 1929.

Further investigations have been made with regard to cleaning methods for apples [*R.A.E.*, A, xv, 425], especially in the Hudson Valley, where the removal of unsightly deposits is the chief problem, though it has been found that the process adopted eliminates also any arsenic that may be present on the fruit. Hydrochloric acid is the only cleaning agent that has given satisfactory results, and even this does not function well when used as a spray for fruit hanging on the tree. The most suitable strengths are from 1 : 100 to 1 : 500, and treatment should be for one minute or less, in a wooden container. Alkalis and oils proved unsatisfactory; fruit treated with alkali wilts in storage, and pears become discoloured. Hand-wiping of the fruit encourages decay and wilting and sometimes injures its appearance, and is also very expensive. It is best to wash the fruit at picking time, and washing must be followed by rinsing, if possible, in running water. The action of the acid is impeded by low temperature, wax, oil and dirt.

CLAYTON (E. E.). **Studies of the Black-rot or Blight Disease of Cauliflower.**—*Bull. New York Agric. Expt. Sta.*, no. 576, 44 pp., 9 figs., 17 refs. Geneva, N.Y., November 1929.

In the course of these studies of black-rot or blight disease of cauliflower, it was demonstrated by experiments that insects are not responsible for its dissemination.

STREETER (L.R.) & HARMAN (S. W.). **Spray Residues.**—*Bull. New York Agric. Expt. Sta.*, no. 579, 12 pp. Geneva, N.Y., December 1929.

Storage tests with apples of different varieties washed in hydrochloric acid solutions of 1 to 35 and 1 to 50 by volume indicated that the former strength is somewhat too strong.

PARROTT (P. J.) & GLASGOW (H.). **The Rosy Aphid in Relation to Spray Practices in 1929.**—*Bull. New York Agric. Expt. Sta.*, no. 582, 32 pp., 7 figs. Geneva, N.Y., February 1930.

Further experiments made to ascertain the value of different insecticides against *Anuraphis roseus*, Baker (rosy aphis) are described [*cf. R.A.E.*, A, xiii, 255; xvi, 459, etc.]. The results, which are summarised in tables, are based on counts of over 250,000 apples. The lime-sulphur and nicotine sulphate spray [xvi, 459] proved preferable to any other tried, 3 lb. of lead arsenate being used instead of 2½ lb. This spray also destroys other Aphids present, and if lime-sulphur is used at the rate of 1 to 8 or 11 gals. of the concentrate in 100 gals. of water, Coccids and the woolly aphis [*Eriosoma lanigerum*, Hausm.] will also be controlled.

For 25-year-old trees the dosage suggested is 10 to 12 gals. to each tree. The status of oil sprays as an alternative treatment is discussed, though these are not likely to be very generally used in view of the desirability of combining insecticide and fungicide treatment.

HOWARD (N. F.). **The Mexican Bean Beetle in the East and its Control.** *Fmrs.' Bull. U.S. Dept. Agric.*, no. 1624, 14 pp., 10 figs. Washington, D.C., March 1930.

This revised edition of a bulletin on *Epilachna corrupta*, Muls., previously noticed [*R.A.E.*, A, xii, 395] gives detailed instructions for the application of the magnesium arsenate spray recommended.

PETTIT (R. H.) & TOLLES (G. S.). **The Cherry Fruit-flies.**—*Circ. Bull. Michigan Agric. Expt. Sta.*, no. 131, 11 pp., 8 figs. East Lansing, Mich., March 1930.

An account is given of the seasonal history and habits of the cherry fruit-flies, *Rhagoletis cingulata*, Lw., and *R. fausta*, O.S., and of the measures for control recommended to growers who are intending to tin their fruit [*R.A.E.*, A, xv, 93]. The spray recommended for use immediately after emergence of the flies consists of 2½ lb. powdered lead arsenate with or without the addition of 2½ U.S. gals. of liquid lime-sulphur to each 100 U.S. gals. of water; only one application is necessary as a rule in Michigan. The date of emergence of the flies is determined by the use of cages [xiv, 580].

METZGER (F. W.). **Methods used in testing Materials as Repellents against the Japanese Beetle.**—*J. Agric. Res.*, xl, no. 7, pp. 659–671, 6 figs., 3 refs. Washington, D.C., 1st April 1930.

This paper describes the methods employed during 1927–28 in testing over 450 different materials and combinations as repellents for *Popillia japonica*, Newm. (Japanese beetle). Various substances,

numbering 306 in all, were tested in comparison with one of the well-known attrahents, geraniol or eugenol combined with a carrier, and the method of baiting in 6-oz. tins is described. A list is given of these materials arranged according to the degree by which they decreased the attraction of the attrahent; the most successful was o-cresol. The purpose of these preliminary tests was to obtain an indication of the value of a large number of materials in as short a time as possible. Experiments in spraying or dusting entire trees with resins, oleoresins and balsams indicated that the fruit was not protected sufficiently long for the treatments to be of value, but certain materials of a resinous nature, which leave little perceptible residue but which stick well to fruit and foliage of peach, appear to have much better repellent properties than a number of pharmaceutical extracts that were tested. Cage tests are described and the results discussed; lead arsenate and hydrated lime was proved to be a dust that is strongly repellent to the beetle.

Thirteen materials were tried in vaporising apparatus, which is described; of these, carvacrol, o-chlorophenol, coal-tar neutral hydrocarbon oil, o-cresol, Dippel's oil, methyl anthranilate, pine-tar oil and quinoline reduced the infestatation by at least 75 per cent. in each test. Various vapour-dispensing devices were tried without any success; some protection was afforded to the foliage, but infestation of the fruit was only checked for from 1 to 3 days.

Struble (G. R.). **The Biology of certain Coleoptera associated with Bark Beetles in Western Yellow Pine.**—*Univ. Calif. Pub. Ent.*, v, no. 6, pp. 105–134, 6 figs., 38 refs. Berkeley, Cal., 19th March 1930.

In this account of the Coleoptera found associated with bark-beetles under the bark of dead or dying trees of western yellow pine [*Pinus ponderosa*], the more important were found to be the Histerids, *Platysoma punctigerum*, Lec., and *Plegaderus nitidus*, Horn, the Tenebrionid, *Hypophloeus substriatus*, Lec., and the Staphylinid, *Nudobius pugetanus*, Csy. A detailed description of all stages of each of these is given. In each case the beetles gain entrance under the bark through the ventilation holes made by the borers.

Platysoma punctigerum is an important predator distributed throughout the yellow pine region of Oregon, California and Arizona, and it occurs in moderately large numbers under the bark of trees recently killed by *Dendroctonus brevicomis*, Lec., or other Scolytid beetles. The larvae have been observed to feed upon those of various Coleoptera and Diptera, though the larvae of *D. brevicomis* are inaccessible to it. The adults prey on the larval and adult stages of a number of insects found under the bark, including the adults of *D. brevicomis* and of *Ips emarginatus*, Lec. The total period required to complete a life-cycle during the summer is 7–9 weeks, and two complete generations are produced during the summer, the adults of the second overwintering under the bark. Oviposition usually begins in May and continues for a period of 3–5 weeks, the eggs being laid in small groups along the sides of bark-beetle egg galleries and sometimes in the frass material. The egg stage lasts 10–14 days, and the larval from 4 to 6 weeks, at temperatures between 65° and 90° F. Pupation occurs in a chamber in the frass, the prepupal stage lasting 2–4 days and the pupal 10–14. The second brood appears between 25th September and 15th

October. Although *P. punctigerum* has very little effect on the developing brood of *D. brevicomis*, as it enters the egg galleries of the latter 3–4 weeks after the borer has made its attack and the egg-laying is very nearly completed, its importance as a beneficial insect rests in the fact that some of the adults of *D. brevicomis* that are preyed upon by the beetle would ordinarily bore their way out of the bark and infest other trees.

Plegaderus nitidus occurs in Nevada, California and Oregon and may prove to be valuable as feeding on eggs of *D. brevicomis* ; further studies are, however, necessary to determine its importance. There is one generation a year. Hibernation occurs in the adult and larval stages. In the Modoc region eggs are laid by the overwintered adults probably at the end of May and in June, and the larvae require 8–10 weeks to reach maturity ; pupation takes place in September, and the young adults emerge during the latter part of the month and in October hibernate under the bark. The overwintered larvae give rise to adults by the middle of July, and these enter trees that have been recently infested by *D. brevicomis* ; eggs are probably laid in the frass. The resulting larvae are only half-grown when cold weather comes and hibernate to complete their development in the following spring. They feed upon very small Coleopterous and Dipterous larvae under the bark ; in the laboratory the adults preyed on the eggs of *D. brevicomis*, and in nature they were observed to enter its egg galleries two weeks after the tree had been infested.

Hypophloeus substriatus is common in the mountains of Oregon and California, and should not be confused with its eastern representative, *H. parallelus*, Melsh., which does not extend west of Arizona and the Rocky Mountains. There is one generation a year in two broods, one of which hibernates in the adult and the other in the larval stage. Many species of *Hypophloeus* have been considered to be predacious, but the laboratory observations of the author proved that both larvae and adults of *H. substriatus* feed exclusively on fungi under the bark, and could not be induced to prey on either living or dead insects. It is thought, therefore, that *H. substriatus* is probably of little importance either as a beneficial or injurious species.

N. pugetanus, of which *N. corticalis*, Csy., is considered a variety, is found in Washington, Oregon and northern California ; it has sometimes been recorded as *N. cephalus*, Say, which occurs in the eastern United States and has incorrectly been reported from the West. There is one generation a year, the life-cycle, which is described, being completed in 10–12 weeks. This species is probably not of any special economic importance, as it preys exclusively on the secondary insects under the bark and may destroy some of the beneficial forms.

ROOKE (H. G. D.). **Iraq : Note on the Campaign conducted in Northern Area against Moroccan Locusts** (*Dociostaurus maroccanus*).—*Int. Bull. Plant Prot.*, iv, no. 3, pp. 34–37. Rome, March 1930.

An account is given of the work against *Dociostaurus maroccanus*, Thunb., in 1928 in Iraq. Hatching became general from 20th to 31st March. In parts of the infested areas where lack of rainfall resulted in an absence of natural vegetation, the locusts that hatched dissappeared entirely. Death from starvation, destruction by birds, and the appearance of large swarms of *Schistocerca gregaria*, Forsk. (*peregrina*, Ol.)

(said by the Bedouins to devour the newly hatched individuals) are the reasons advanced for this disappearance. The use of a poison-bait was the chief measure employed. The formula used contained 1 part sodium arsenite, 2 parts molasses, and 15 parts bran. One belt, twenty-one miles in length, of third and fourth stage individuals, was entirely destroyed in five days. It was found that 5 lb. of sodium arsenite, with the necessary quantities of molasses and bran, were sufficient for a line of about 1,000 yards of third-stage hoppers. It is estimated that the ploughing of infested areas destroys at least 50 per cent. of the eggs, either mechanically or by exposure to weather or birds. Furthermore, locusts will not oviposit in such ground, as they require a firm compact soil. Very little trenching was done in 1928. Fuel oil, sprayed under pressure to prevent wastage, is an excellent contact poison, but it is possible to bait ten times the area that can be oiled in the same time.

Natural enemies included the Clerid beetle, *Trichodes laminatus*, Chevr., and the Bombyliid fly, *Thyridanthrax* sp.

DE LÉPINEY (J.). **Sur la biologie du criquet pélerin.**—*C.R. Acad. Sci. Fr.*, cxc, no. 19, pp. 1145–1147. Paris, 1930.

In this study of *Schistocerca gregaria*, Forsk., ph. *gregaria* during the invasion of Morocco in 1929–30, the activity of both larvae and adults was found to be closely connected with the body temperature of the insects, which is influenced by a number of factors, the principal of which are wind, air temperature, soil temperature, insolation and heat produced by movement. The daily regime of the hoppers is outlined ; each particular activity appears to depend on a certain degree of air temperature. Feeding is not a distinct phase in their behaviour, but occurs whenever they are not very active, usually in the mornings and evenings. The behaviour of the adults is very similar to that of the hoppers, the flight corresponding to migrations in the larval stage.

MANZONI (L.). **Un nuovo nemico della vite. Il** *Plagitmesus erythrocephalus*.—*Ann. Staz. sperim. Vitic. Conegliano*, iii, no. 2, reprint 7 pp., 2 figs. Treviso, 1930.

The larvae of the Cerambycid beetle, *Neoclytus acuminatus*, F (*Plagitmesus erythrocephalus*, F.) have been found boring in the branches of grape-vines in North Italy. This species, which is a forest pest in North America, has also been recorded from Carniola and Istria. The adult probably oviposits on the vine in summer on the wood of the previous year, and the larva lives in the branch until the following July or August.

SCHOEVERS (T. A. C.). **Vermeende en werkelijke gevaren verbonden aan het gebruik van giftige bestrijdingsmiddelen in land- en tuinbouw.** [Supposed and real Dangers connected with the Use of poisonous Control Materials in Agriculture and Horticulture.].—*Tijdschr. Plantenziekt.*, xxxvi, no. 2, pp. 24–44, 1 pl., 40 refs. Also as *Versl. & Meded. Plantenziekt. Dienst*, no. 61, 21 pp., 1 pl. Wageningen, February 1930.

This is a discussion, based on published data, of the danger to man,

domestic animals and bees of poisoning by arsenic, mercury, copper, etc., used as insecticides. The conclusion reached is that the danger has been over-estimated provided that the applications are properly carried out.

van Poeteren (N.). **Bestrijdingsmiddelen tegen plantenziekten voor twintig jaar en thans.** [Materials for combating Plant Diseases twenty Years ago and now.]—*Tijdschr. Plantenziekt.*, xxxvi, no. 3, pp. 49–61. Wageningen, March 1930.

An account is given of recent progress respecting the use of insecticides, etc., in Holland.

Boedijn (K. B.) & Steinmann (A.). **Over de op thee en andere cultuurplanten in Ned.-Indië optretende** *Helicobasidium-* **en** *Septobasidium-***soorten.** [On the species of *Helicobasidium* and *Septobasidium* occurring on Tea and other cultivated Plants in the Dutch East Indies.]—*Arch. Theecult. Ned. Ind.*, no. 1, pp. 5–59, 29 pls., 70 refs. Buitenzorg, February 1930. (In Dutch and English.)

All species of *Septobasidium* are parasitic on colonies of scale-insects. These fungi require a certain amount of moisture and do not cause any noticeable injury to the plants.

Camacho (C.). **La** *Icerya purchasi.*—*Rev. chil. Hist. nat.*, xxxiii (1929), pp. 569–572. Santiago, 1930.

A brief account is given of the bionomics and control of *Icerya purchasi*, Mask., in view of its recent discovery on orange in Chile.

Villeneuve (J.). **Diptères nouveaux de la Somalie italienne.**—*Boll. Soc. ent. ital.*, lxii, no. 3, pp. 53–55, 3 figs. Genoa, 26th March 1930.

The new species described include : *Sarcophaga flagellata*, bred from *Dacus brevistylus*, Bezzi, and *Blaesoxypha anceps*, the larvae of which are parasitic in *Cyrtacanthacris tatarica*, L., and other Acridids.

Box (H. E.). **Una relación de nuestros conocimientos de la familia Cercopidae en la Argentina. Con un informe sobre tres especies de** *Tomaspis*, **Am. & Serv., que atacan la caña de azúcar en las provincias del Norte.** [An Account of our Knowledge of the Cercopidae in Argentina. With a Report on three Species of *Tomaspis* attacking Sugar-cane in the Provinces of the North.]—*Rev. ind. agríc. Tucumán*, xx, no. 1–2, pp. 5–17, 8 figs. Buenos Aires, 1929.

The information available on the Cercopidae of Argentina is briefly summarised. Three species of *Tomaspis*, *T. knoblauchi*, Berg, *T. australis*, Dist., and *T. entrerriana*, Berg, occur in north Argentina. *T. knoblauchi* is apparently of the most economic importance, but not sufficiently so to call for control.

TOSI (R.). **Contributo alla conoscenza di due tignole del grano** (*Plodia interpunctella* **Hb. e** *Tinea granella*). [A Contribution to the Knowledge of two Grain Moths.]—*Boll. Lab. Ent. Bologna*, ii, pp. 292–300, 3 graphs. Bologna, 1929.

The adults of *Plodia interpunctella*, Hb., begin to appear at the end of May and the beginning of June. Oviposition lasts 2–5 days, the eggs being laid singly or in batches of 2–5 to a total of 40–90. Incubation at 25° C. [77° F.] lasts 3 days. The larvae usually hatch in the morning and pupate about the first fortnight in August, the pupal stage lasting about 10 days at 25° C. The adults of the second generation begin to emerge in the middle of August and are on the wing up to the end of October. The larvae they give rise to usually hibernate in a fully mature state, pupating in the first fortnight of May. In cases of severe infestation the two generations overlap, adults being always present from June to October or later. *P. interpunctella* attacks many dry or nearly dry vegetable substances, being particularly injurious to cereals. The author has obtained complete generations from maize, soy bean [*Glycine hispida*], bran, wheat, rye, rice, *Sesamum*, hazel-nut, almond, walnut, and ground-nut. It also mines and develops in chocolate. There is sometimes a heavy larval mortality believed to be due to bacterial disease. Many larvae are killed by the mite, *Pediculoides ventricosus*, Newp., and two Braconid parasites, *Microbracon* (*Habrobracon*) *hebetor*, Say (*brevicornis*, auct.) and *Opius carinatus*, Thoms. var.

The adults of *Tinea granella*, L., appear towards the end of April, and emergence continues until the first fortnight in July. The adults can survive for eleven days without food ; normally they live for fifteen to twenty days. From 40 to 80 eggs are laid, usually in 3 days. Incubation takes 4 days at 25° C. The larvae develop on various dry vegetable foodstuffs. Generations have been bred on wheat, rye, maize, almond, hazel-nut, walnut, ground-nut and bran. In summer the pupal stage lasts 10–12 days ; in spring, 18–20. The adults of the second generation begin to appear in the second half of August and are on the wing up to the end of October. The larvae that they give rise to hibernate. As with *P. interpunctella*, it is not easy to differentiate the overlapping generations. Hymenopterous parasites were not observed, but the mite, *Pediculoides ventricosus*, is a most effective enemy.

An investigation on the effect of the temperature on the development of these two moths showed that *T. granella* can develop at 6·4° C. [43·52° F.], whereas the minimum for *P. interpunctella* is 11·1° C [51·98° F.]. At 13·48° C. [56·264° F.] both species develop with equal rapidity in 216 days. At 12·9° C. [55·22° F.] *T. granella* requires 232–235 days and *P. interpunctella* 271–288. At 28·2 °C. [82·76° F.] the former requires 70 days, and the latter 30.

GRANDI (G.). **Nota su un betilide del gen.** *Cephalonomia* **Westw. e contributo alla conoscenza della morfologia della famiglia.** [A Note on a Bethylid of the genus *Cephalonomia* and a Contribution to the Knowledge of the Morphology of the Family.]—*Boll. Lab. Ent. Bologna*, ii, pp. 301–314, 9 figs. Bologna, 1929.

Cephalonomia sp. is recorded as having been found associated with the beetles, *Sitodrepa panicea*, L., and *Silvanus* (*Oryzaephilus*) *surinamensis*, L. ; it is uncertain on which it was parasitic, though it has previously been recorded as a parasite of the latter [*R.A.E.*, A, xviii, 199]. Descriptions are given of the apterous female and alate male of this Bethylid.

CHIAROMONTE (A.). **Una particolare circostanza favorevole allo sviluppo della cotonicoltura a Tessenei : l'assenza di *Platyedra gossypiella*, Saund.** [A peculiar Circumstance favourable to the Development of Cotton Growing at Tessenei : the Absence of *P. gossypiella*.]—*Agric. colon.*, xxiv, no. 4, pp. 185–188. Florence, April 1930.

The Tessenei zone in Eritrea is specially favourable for cotton growing owing to the absence of *Platyedra gossypiella*, Saund. *Heliothis* (*Chloridea*) *obsoleta*, F., is also absent, *Diparopsis castanea*, Hmps., is very rare and *Earias biplaga*, Wlk., is uncommon. *Sphenoptera patrizii*, Obenb., and *Aphis gossypii*, Glov., occur, but are not such serious pests. *Dysdercus* and *Oxycarenus* are unknown, and *Nezara* is rare.

VAN ZYL (J. P.). **On the Toxicity of Arsenic to Fowls.**—*15th Rep. Vet. Serv. S. Afr.*, ii, pp. 1189–1202, 12 refs. Pretoria, October 1929. [Recd. 1930.]

In view of the possible danger to poultry and other live stock of eating locusts killed with arsenical sprays, experiments were made to determine the toxicity of arsenic to fowls, the arsenic content of sprayed locusts and the effect of feeding them to fowls. It was found that fowls of average weight ($4\frac{1}{2}$ lb.) could easily tolerate as much as 20–25 mg. ($\frac{1}{3}$ grain) dissolved arsenic trioxide (As_2O_3), administered in the form of sodium arsenite, three times a week for several successive weeks ; this amount would rarely if ever be obtained if poisoned locusts or locust meal were given at the rates ordinarily recommended. The minimum quantity of soluble arsenic lethal to an average large fowl in a single dose appears to be about 75 mg. As_2O_3, and the minimum lethal dose of insoluble white arsenic about 150 mg. ($2\frac{1}{2}$ grains).

The arsenic content of a quantity of flying locusts, determined the day after they had been heavily sprayed, was 75 mg. As_2O_3 to 100 gm. In some cases, locusts supposed to have been killed by spraying contained up to 100 mg. As_2O_3 to 100 gm., but such high values must be due to excessive spraying or to spilling of poison. Freshly sprayed locusts appear to contain more arsenic than veldt-dried material, and hoppers tend to contain more than an equal weight of winged individuals. In most samples tested, the arsenic content was less than 25 mg. to 100 gm.

Increasing quantities of meal made from ground locusts containing 75 mg. As_2O_3 to 100 gm. were fed to six fowls for three months, the maximum daily dose of each bird being 20 mg. As_2O_3, without causing ill effects. Two of these fowls were killed and roasted five days after the last feed with locusts, and no unpleasant flavour could be detected in the flesh. It is therefore evident that dried locusts or locust meal containing the exceptionally high figure of 120 mg. As_2O_3 to 100 gm. can be fed to fowls in quantities up to 3 oz. weekly for an average large bird, with absolute safety, and that danger from feeding sprayed locusts to poultry is almost negligible.

With regard to cattle and farm stock generally, the author considers that there is no danger of poisoning from locusts containing up to 25 mg. As_2O_3 to 100 gm., but that if the arsenic content is between 25 and 50 mg., care should be exercised, especially with pigs, and if it is higher, the material would be safe only in small quantities. Freshly sprayed locusts should always be regarded as unsafe. Local excessive use of arsenic, and residues from spilling the spray, are a greater source of danger than the locusts themselves.

Sison (P. L.). **Some Notes on the White Pyralid Moth Borer** (*Scirpophaga innotata* **Walker) and Suggestions for its Control.** —*Philipp. Agric. Rev.*, xxii, no. 4, pp. 333–343, 2 pls., 5 refs. Manila, 1929.

An account is given of the life-history of the Pyralid, *Scirpophaga innotata*, Wlk. (*sericea*, Snell.), which is a serious pest of rice in the Philippines, its habits being very much the same as those of *Schoenobius bipunctifer*, Wlk., (*incertellus*, Wlk.) [*R.A.E.*, A, v, 574]. All stages are described, the information given on the bionomics and control of the pest having been already noticed from other sources [iv, 85 ; xiii, 466].

Pierce (W. D.). **Notes on the Cañafistula Weevils of the Genus** *Phelomerus* **Pic (Coleoptera : Mylabridae.)** —*Proc. Ent. Soc. Wash.*, xxxii, no. 3, pp. 37–48, 1 pl., 9 figs. Washington, D.C., March 1930.

A detailed description is given of the larva, pupa and adult of the Bruchid, *Phelomerus ochropygus*, Pic, intercepted in seeds of *Cassia grandis*, imported into the United States from Panama. *P. aberrans*, Sharp, is recorded from Panama and British Honduras as infesting *Cassia*, and the characters distinguishing the adult from that of *P. ochropygus* are given.

Peterson (A.). **The Problem of the Oriental Peach Moth.**—*Proc. New York St. Hort. Soc.*, xxv, pp. 38–49. Le Roy, N.Y., 1930.

This paper, which is very similar to one already noticed [*R.A.E.*, A, xviii, 122], contains a review of the possibilities of insecticidal and cultural control of each individual stage of *Cydia molesta*, Busck [xvii, 372, etc.]. In spite of the work done during the last two years, the author is still of the opinion that no satisfactory cultural practice or insecticide that could be recommended has been developed, but thinks that success may be attained by the biological control of the pest. Of the forty or more species of parasites reared from the several stages of *C. molesta* [*cf.* xviii, 163], the most important are *Trichogramma minutum*, Riley, which attacks the eggs, and the larval parasites, *Macrocentrus ancylivora*, Rohw., and *Glypta rufiscutellaris*, Cress. The introduction of parasites is recommended, and all support should be given to the work in this connection, which may prove to be of great value within a few years.

Mundinger (F. G.). **Apple Maggot and Pear Midge Investigation.**—*Proc. New York St. Hort. Soc.*, lxxv, pp. 168–171. Le Roy, N.Y., 1930.

The injury caused by the apple maggot [*Rhagoletis pomonella*, Walsh] and the pear midge [*Contarinia pyrivora*, Riley] in the Hudson Valley has become more general and severe during the past five years. Factors favouring the spread of the apple maggot and complicating its control are briefly outlined. The infestation could practically be eliminated by gathering the infested apples soon after they fall to the ground and burying them at least two feet deep, or otherwise destroying them ; but most growers find this practice a difficult one. Spraying or dusting, with thorough cultivation must therefore, be relied upon. Correct timing of the protective applications is very important, the best guide for this being the emergence cages, which should be placed in orchards about the middle of June [*R.A.E.*, A, xv, 424].

The work in connection with the study of the bionomics and control of the pear midge during the year is very briefly reviewed [xvii, 367]. Lime-sulphur 1–40 with $\frac{3}{4}$ pint nicotine sulphate to 100 gals. appeared the most promising of the materials used. The time for the first application is when the individual cluster-buds are swollen and a trace of pink is visible; measures are useless if delayed until the petals are unfolded.

Mutchler (A. J.). **A Japanese Weevil,** *Calomycterus setarius* **Roelofs, which may become a Pest in the United States.**—*Amer. Mus. Novit.*, no. 418, 3 pp., 1 fig. New York, 31st March 1930.

The weevil, *Calomycterus setarius*, Roelofs, which was described from Japan in 1873, and is apparently new to the North American fauna, has been observed in large numbers in New York State, thousands being attracted to any light-coloured object in the gardens of the district. The weevils were found abundantly on American and Japanese ivy, rose bushes, geranium, woodbine, etc., and it is thought quite possible that this species may become economically important in the eastern United States. A description of the adult is given. It cannot fly and is therefore unlikely to spread rapidly.

Smith (F. F.). **Studies of the Black Vine Weevil. (Abstract).**—*J. Wash. Acad. Sci.*, xx, no. 10, pp. 185–188. Baltimore, Md., 19th May 1930.

Otiorrhynchus (*Brachyrrhinus*) *sulcatus*, F., which is widely distributed in Pennsylvania, is occasionally a serious pest of many plants. There is one annual generation, hibernation occurring occasionally in the adult, but generally in the prepupal or immature larval stage in the soil. The larvae begin feeding in March, and most of them pupate at the same time as the over-wintering prepupae in May. About 3 weeks later, they become adults and remain inactive in their cells for 5–10 days. They emerge from the soil in early June. Oviposition begins about the middle of July and usually ceases by early September, but may continue till October. The number of eggs laid varies greatly with the food-plant, smaller numbers being laid where this is strawberry or yellow dock, and large numbers on primroses or plantain.

The weevil may live continuously in greenhouses, but usually the adults come from outside and oviposit during July and August. The resulting eggs give rise to larvae that mature in November or December, and these destroy the roots and burrow into the crowns of plants just coming into bloom for the Christmas market. During the first 3 or 4 instars the larvae feed on the small rootlets, and only later cut and eat the larger roots, crowns or corms. The adults prefer flowers to foliage, but eat out characteristic notches in both. They are nocturnal and hide by day.

No male was found among several thousand individuals examined externally, or among 1,200 dissected; nevertheless, 6 generations reared in isolation all produced fertile eggs. The larvae of *Harpalus caliginosus*, F., are predacious on those of the weevil.

Powdered acid lead arsenate in the soil was the only material found that was toxic to the larvae, and it did not harm cyclamen or primroses, the two most usual food-plants. One ounce of the insecticide to one bushel of potting soil should be used, but as many other plants are severely injured by small quantities of lead arsenate in the soil, it

cannot be recommended for general use. A sweetened, poisoned bran bait was effective against the adults, but if staining of the foliage is immaterial, a dust of equal parts of calcium arsenate and hydrated lime may be used.

Tests made to check the food-plants pointed to the probability that *O. sulcatus* has been confused with other weevils. It is evidently not a grass-feeder, though it thrives on weeds such as dock, sorrel, dandelion and plantain, and these should be destroyed near greenhouses.

Papers noticed by Title only.

Butenandt (A.). **Ueber das Rotenon, den physiologisch wirksamen Bestandteil der** *Derris elliptica*. [Rotenon, the physiologically active Constituent of *D. elliptica*.]—*Just. Liebigs Ann. Chemie*, ccccl xiv, no. 3, pp. 253–277. Berlin, 12th July 1928.

Butenandt (A.) & Hildebrandt (F.). **Untersuchungen über pflanzliche Fisch- und Insektengifte. II. 2. Mitteilung über Rotenon, den physiologische wirksamen Bestandteil der** *Derris elliptica*. [Investigations on vegetable Fish and Insect Poisons. II. Second Communication on Rotenon, the physiologically active Constituent of *D. elliptica*.]—*Just. Liebigs Ann. Chemie*, cccclxxvii, no. 3, pp. 245–268. Berlin, 11th January 1930.

Lebedev (A. G.) & Savenkov (A. N.). **Einige neue Ergebnisse aus der Biologie und Physiologie des Kieferspinners** (*Dendrolimus pini*, **L.**). [Some new Data on the Biology and Physiology of *D. pini*.]—*Z. angew. Ent.*, xvi, no. 1, pp. 159–177, 1 fig., 7 refs. Berlin, March 1930. [See *R.A.E.*, A, xviii, 336.]

Kerenski (J.). **Beobachtungen über die Entwicklung der Eier von** *Anisoplia austriaca* **Reitt.** [Observations on the Development of the Eggs of *A. austriaca*.]—*Z. angew. Ent.*, xvi, no. 1, pp. 178–188. Berlin, March 1930.

Gautier (C.) & Cleu (H.). **Un** *Chelonus* [*hiemalis*, sp. n.] (**Hym. Braconidae**) **parasite de la chenille d'***Argyresthia chrysidella* **Peyer. (Lep. Tineidae.)**—*Bull. Soc. ent. Fr.*, 1930, no. 11, pp. 196–198. Paris, 1930.

Morstatt (H.). **Bibliographie der Pflanzenschutzliteratur. Das Jahr 1929.** [A Bibliography of Plant Protection Literature in 1929.]—*Biol. Reichsanst. Land- u. Forstw.*, iv+246 pp. Berlin, P. Parey; J. Springer, 1929. [*Cf. R.A.E.*, A, xvii, 544.]

Shull (A. F.). **Control of gamic and parthenogenetic Reproduction in winged Aphids by Temperature and Light.**—*Z. indukt. Abstamm.- u. Vererbungslehre*, lv, no. 1–2, pp. 108–126, 4 refs. Leipzig, 1930.

Paillot (A.). **Mécanisme de la symbiose chez le** *Drepanosiphum platanoides*.—*C.R. Soc. Biol.*, ciii, no. 13, pp. 1138–1139, 1 fig., 1 ref. Paris, 4th April 1930.

Priesner (H.). **Indomalayische Thysanopteren II.**—*Treubia*, xi, pt. 3, pp. 357–371, 10 figs. Buitenzorg, 1930.

Grandi (G.). **Studio morfologico e biologico della** *Blastophaga psenes* (**L.**). **2ª edizione riveduta.** (**29° contributo alla conoscenza degli insetti dei fichi.**)—*Boll. Lab. Ent. Bologna*, ii, pp. 1–147, 47 figs., 416 refs. Bologna, 1929. [1st edn., *see R.A.E.*, A, viii, 534.]

McLaine (L. S.). **The Gypsy Moth** [*Porthetria dispar*, L.] **Outbreak in Southern Quebec.**—*J. Econ. Ent.*, xxiii, no. 1, pp. 38–41, 2 refs. Geneva, N.Y., February 1930. [*Cf. R.A.E.*, A, xiii, 581; xv, 39,; xvi, 597.]

UCHIDA (T.). **Beitrag zur Kenntnis der Ichneumonidenfauna der Insel Izu-Ohshima.**—*Trans. Sapporo Nat. Hist. Soc.*, xi, pt. 2, pp. 78–87, 3 figs. Sapporo, 1930.

COCKERELL (T. D. A.) & BUEKER (E. D.). **New Records of Coccidae (Homoptera). 1.—A new grass-feeding Coccid from New Caledonia. 2.—A new Genus of Diaspinae from Java. 3.—A new Wax-scale from Haiti. 4.—A new Lecaniine Subgenus.**—*Amer. Mus. Novit.*, no. 424, 8 pp., 18 figs. New York, N.Y., 28th June 1930.

WILLE (J.). **Insectos perjudiciales que atacan a las papas en el Perú.** [Injurious Insects attacking Potatoes in Peru.]—*Circ. Estac. exper. agríc. Soc. nac. agrar.*, no. 16, 6 pp., 4 figs. Lima, October. 1929. [*See R.A.E.*, A, xviii, 322.]

WENDT (—). **Moderne Apparate zur Schädlingsbekämpfung.** [Modern German Apparatus for Dusting and Spraying.]—*Anz. Schädlingsk.*, vi, no. 3, pp. 27–32, 10 figs. Berlin, 15th March 1930.

CAMPBELL (R. E.) & DURAN (V.). **The Egg of** *Laphygma exigua* **Hübner.**—*Proc. Ent. Soc. Wash.*, xxxii, no. 3, p. 48, 1 fig. Washington, D.C., March 1930.

HOWARD (N. F.) & BRANNON (L. W.). **The Mexican Bean Beetle** [*Epilachna corrupta*, Muls.] **and its Control.**—*Bull. Virginia Truck Expt. Sta.*, no. 70, pp. 801–808, 4 figs., 1 ref. Norfolk, Va., 1st January 1930. [*Cf. R.A.E.*, A, xvi, 399 ; xvii, 618 ; etc.]

OGLOBLIN (A. A.). **A new Species of** *Telenomus* [*sacchii*, sp. n.] **Parasite of** [the Eggs of the Leafhopper] *Hysteropterum liliimacula* **Costa.**—*Mem. Soc. ent. ital.*, ix, pp. 41–45, 3 figs. Genoa, 1930.

STEINER (P.). **Beobachtungen zur Biologie von** *Cratotechus longicornis* **Thoms. (Hym., Chalc.)** [Parasite of *Notolophus antiquus*, L.].—*Z. wiss. InsektBiol.*, xxv, no. 1–2, pp. 19–23, 3 figs. Berlin, 30th April 1930.

LEEFMANS (S.). **Preliminary List of Parasites and Predators of some important Insect Pests in the Netherlands Indies.**—*Proc. 4th Pacific Sci. Congr. Java*, 1929, reprint 8 pp. [? Batavia, 1929.]

A List of the Entomologists employed in the British Empire.—Med. 8vo, 16 pp. London, Imp. Bur. Entom., 1930. Price, 2*s.* 6*d.*

MARSHALL (W. S.). **The hypodermal Glands of the black Scale,** *Saissetia oleae* **(Bernard). II. The ventral Glands.**—*Trans. Wisconsin Acad. Sci. Arts Lett.*, xxv, pp. 255–272, 3 pls., 22 refs. Madison, Wis., May 1930. [*Cf. R.A.E.*, A, xviii, 40.]

MORISON (G. D.). **On a Collection of Thysanoptera from South Australia.**—*Bull. Ent. Res.*, xxi, pt. 1, pp. 9–14, 1 fig. London, March 1930.

PARK (O.). **Studies in the Ecology of Forest Coleoptera. Seral and seasonal Succession of Coleoptera in the Chicago Area, with Observations on certain Phases of Hibernation and Aggregation.**—*Ann. Ent. Soc. Amer.*, xxiii, no. 1, pp. 57–80, 36 refs. Columbus, Ohio, March 1930.

SCHRADER (F.). **Observations on the Biology of** *Protortonia primitiva* **(Coccidae).**—*Ann. Ent. Soc. Amer.*, xxiii, no. 1, pp. 126–132, 1 fig., 3 refs. Columbus, Ohio, March 1930.

DRATHEN (T.). *Trioza alacris* **F., en Chile.** [The Psyllid, *T. alacris*, new to Chile, on *Laurus nobilis*.]—*Rev. chil. Hist. nat.*, xxxiii (1929), p. 53. Santiago, 1930.

ROHWER (S. A.). **Pink Bollworm in Arizona. (Abstract.)**—*J. Wash. Acad. Sci.*, xx, no. 10, pp. 189–190. Baltimore, Md., 19th May 1930.

Infestation by the pink bollworm [*Platyedra gossypiella*, Saund.] has been discovered at 25 different points in the Salt River valley, and in some fields in the eastern part of the valley 45 per cent. of the cotton bolls were attacked. The non-cotton zone is surrounded by a protective one, three miles in width, where restrictions are placed on the date when cotton may be planted. It is hoped that an appropriation of £117,500 for cleaning up of these zones will make possible the eradication of the moth from this area.

MILLER (A. E.). **Habits and Control of Termites.**—*Circ. Illinois St. Nat. Hist. Survey*, Entom. Ser., 11, 12 pp., 6 figs. Urbana, Ill., 1928. [Recd. 1930.]

In this revised edition of a circular previously noticed [*R.A.E.*, A, xv, 292] the damage caused by termites in Illinois is estimated at not less than £1,000,000 a year. Provisions suitable for inclusion in building codes to insure protection from termites [xviii, 114, etc.] are included.

COSTANTINO (G.). **Contributo alla conoscenza della mosca delle frutta** (*Ceratitis capitata* **Wied.**) (**Diptera, Trypaneidae**). [A Contribution to the Knowledge of the Fruit-fly, *C. capitata*.]—*Boll. Lab. Zool. Portici*, xxiii, pp. 237–322, 20 figs., 11 pp. refs. Portici, 1930.

This is a detailed morphological and biological study of the Mediterranean fruit-fly, *Ceratitis capitata*, Wied., a condensed form of which has been noticed [*R.A.E.*, A, xviii, 179]. The differences in the susceptibility to infestation of various Italian fruits are discussed. All stages of the fly are described in full. The egg-stage varies from 2 days at 26° C. [78·8° F.] to 5–6 days at 12° C. [53·6° F.], and the larval stage from 10–11 days in August to 16–20 in November-December. The pupal stage lasted from 8–9 days in July to 24–27 in November–December. At temperatures between 3·3° and 22° C. [37·94° and 71·6° F.]with an average of 12·6° C. [54·68° F.], it may last 2 months. Baits of wine vinegar or molasses from which the sugar had been removed were found to be the best [*loc. cit.*]. Other materials were tried, including the liquid obtained from the olive after the oil has been separated [*cf.* xviii, 367, 368].

RAYNAUD (L.). **Sur un nouvel appareil permettant d'employer la chloropicrine sans masque et sans danger, pour la destruction des parasites des habitations.**—*Bull. Off. int. Hyg. publ.*, xxii, fasc. 4, pp. 763–765, 1 fig. Paris, April 1930.

A simple apparatus, devised by A. Piedallu, that can be used in fumigating with chloropicrin for the destruction of insects in houses and grain stores, is described. It consists of a small wooden platform, pivoted in the middle, and carrying a bottle, the contents of which are emptied by pulling a string attached to the lower end. The free end of the string is carried out through a key-hole or a gimlet-hole in a door or window, which is blocked up as soon as the string has been pulled. The apparatus can thus be manipulated from outside a sealed room.

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HILGENDORFF (G.). **Ueber die Normung des Schweinfurtergrüns für den Pflanzenschutz.** [On a comparative Standard for Paris Green for Plant Protection.]—*NachrBl. deuts. PflSchDienst,* x, no. 4, pp. 28–29. Berlin, April 1930.

The standard of quality suggested for Paris green [*R.A.E.*, A, xv, 112] has been found to require modification. The conditions that the German Plant Protection Service now require to be satisfied are as follows : The fineness as tested in the sulphurimeter must not be under 25° Chancel. Water-soluble arsenite compounds present must not exceed 3·5 per cent. of arsenious oxide (As_2O_3). At least 95 per cent. of the precipitate deposited in water must pass a " 6,400 " sieve [one with a mesh width of 0·075 mm. and a wire thickness of 0·050 mm.]. The residue left in the sieve must not contain particles and impurities likely to choke the sprayers. The arsenious oxide content must be at least 55 per cent., that of oxide of copper (CuO) at least 30 per cent. and of acetic acid at least 10 per cent. There must not be more than 1 per cent. of water. The methods to be followed in making the analysis are described.

KUNZE (—). **Ueber die Giftwirkung von Arsen-Stäubemitteln auf Bienenvölker.** [On the Toxic Action of Arsenical Dust Insecticides on Bee Colonies.]—*NachrBl. deuts. PflSchDienst,* x, no. 5, pp. 35–36. Berlin, May 1930.

Arsenical dust insecticides are indispensable against forest pests in Germany, but by proper distribution of the dust and reduction of As_2O_5 to 10–20 per cent., injury to game and pasture animals is avoided. Experiments with a number of proprietary arsenical dusts indicate that they are toxic to bees, and bee-keepers should carefully obey the instructions issued before a forest is dusted.

APPEL (O.). **Die Biologische Reichsanstalt 25 Jahre selbständige Reichsbehörde.** [The German Imperial Biological Institute an independent Imperial Authority for Twenty-five Years.]—*NachrBl. deuts. PflSchDienst,* x, no. 4, pp. 25–28, 7 figs. Berlin, April 1930.

The German Imperial Biological Institute was founded in 1898, and established as an independent government authority in 1905, with an expenditure of over £8,000. In 1929 the expenditure was over £56,000. The head-office and branches now occupy 39 buildings, and there is a permanent staff of about 200. The branches and mobile field-stations deal with the more direct problems presented by plant pests and diseases.

ZWÖLFER (W.). **Untersuchungen zur Biologie und Bekämpfung des Maiszünslers** (*Pyrausta nubilalis* **Hb.**) **in Süddeutschland. II. Teil.** [Investigations on the Biology and Control of the Maize Borer, *P. nubilalis,* in South Germany. Part II.]—*Arb. biol. Reichsanst.*, xvii, no. 6, pp. 459–498, 6 figs., 7 pls., 21 refs. Berlin, 1930.

This is a report of further investigations on *Pyrausta nubilalis,* Hb. [*cf. R.A.E.*, A, xvi, 56] that were carried out in 1927 with a view to discovering a control method suitable to South German conditions.

The occurrence of the moth in Baden and adjoining regions is recorded, with notes on its food-plants, seasonal occurrence of the various developmental stages, oviposition and hibernation. The percentage of hibernating larvae that survive varies with the thickness of the material forming the winter shelter. July is the critical month for the moth. A series of rainless nights with an average temperature of 18·5°–20·5° C. [65·3°–68·9° F.] provides the optimum conditions for oviposition. The weather in July also influences the development of the eggs and young larvae. In 1927 the mortality in the egg-stage was about 50 per cent., that in the egg and early larval stages combined being about 92. In the later larval stages, diseases and parasites at Rastatt, Baden, only accounted for about 8·6 per cent. of the survivors. The information given regarding parasites and control measures has already been noticed [xvii, 216].

Hähne (H.). **Beitrag zur Biologie und Bekämpfung des Rübenaaskäfers** *Blitophaga opaca* **L.** [A Contribution to the Biology and Control of the Beet Silphid Beetle, *B. opaca*.]—*Arb. biol. Reichsanst.*, xvii, no. 6, pp. 499–548, 10 figs., 9 pp. refs. Berlin, 1930.

Observations carried out in Pomerania in 1926–27 have shown that in favourable dry winters *Blitophaga opaca*, L., can hibernate successfully in a thick litter in coniferous woods or on ground thickly covered with grass, damp moss, etc. [*cf. R.A.E.*, A, xv, 123]. Further notes on its life-history [*cf.* xi, 435] and its natural enemies are given from existing records and the author's own observations. Three Carabids, *Calathus fuscipes*, Goeze, *Poecilus coerulescens*, L., and *P. lepidus*, Leske, are believed to have checked the increase of Silphid larvae in June 1926 at Abtshagen.

In years in which the weather is favourable to beet crops, this pest does not appear to be dangerous on suitable soil where cultivation is on correct lines. If thinning be delayed until the chief infestation is over, the danger of defoliation is much reduced. The best remedy is dusting with an arsenical by means of gauze bags or a mechanical duster such as the "Puhuri" [xvi, 594].

A comprehensive bibliography on beet Silphids is given.

Bondar (G.). **A formiga saúva, praga dos cacaoaes.** [The Leaf-cutting Ant Pest of Cacao Plantations.]—*Correio agric.*, viii, no. 2, pp. 29–32, 1 fig. Bahia, February 1930.

Atta cephalotes, L., is the leaf-cutting ant in the cacao zone in Brazil. Whereas *A. sexdens*, L., cuts the leaves off a tree so that they fall to the ground and are there cut up for transportation to the nest, *A. cephalotes* cuts pieces off the leaves *in situ*, the mutilated remnants remaining on the tree. It is a very serious pest of cacao, and it is not possible to eradicate it, though fumigation of the nests with sulphur reduces the number of ants and is the most practical measure at present.

Argollo Ferrão (V. A.). **Extincção da formiga saúva.** [Extinction of the Leaf-cutting Ants.]—*Correio agric.*, viii, no. 2, p. 32. Bahia, February 1930.

The following method is suggested against the leaf-cutting ants [*Atta* spp.] that are such a serious pest in Brazil. The concave side of

a curved tile is rubbed with the cut surface of a lemon, and mercury bichloride is then sprinkled on it. The tile thus treated is placed over the path of exit from the nest, with the result that all ants passing beneath the tile are said to die.

A vespa da Uganda.—*Correio agric.*, viii, no. 2, p. 40. Bahia, February 1930.

The Bethylid, *Prorops nasuta*, Wtrst., has been imported into Brazil from Uganda in the hope that it may control the Scolytid coffee-berry borer, *Stephanoderes* [*hampei*, Ferr.], and the Biological Institute of S. Paulo now has a stock of about 6,000 individuals.

Leefmans (S.) & van der Vecht (J.). **De rood-geringde mangga-rups.** [The red-ringed Mango Caterpillar.]—*Korte Meded. Inst. PlZiekt.*, no. 14, 6 pp., 2 pls. Buitenzorg, 1930. (With a Summary in English.)

Since 1922, mango fruits have been found to be damaged by the larva of the Pyralid, *Noorda albizonalis*, Hmps., in various parts of Java. The eggs have not been found. The caterpillars, which are described, pupate in the ground in a silk-lined earthen cocoon. A brief description of the adult is given. Mangos of varying size are attacked, as many as eleven individuals being found in one fruit. Development appears to take about five weeks, the larval and pupal stages occupying about a fortnight each. Feeding occurs first on the pulp and then on the seed, which is destroyed. *Mangifera odorata* and some varieties of *M. indica* are attacked. Several insects, including the mango fruit-fly, *Dacus ferrugineus*, F., enter by the lesions caused by *N. albizonalis*. It is not known how this Pyralid survives between two mango harvests. No parasites were bred.

Warburton (C.). **Annual Report for 1929 of the Zoologist.**—*J. R. Agric. Soc. England*, xc, pp. 365–372. London, 1929.

Brief notes are given on a number of insect pests of various crops and forest trees observed in England during 1929.

Hodson (W. E. H.) & Beaumont (A.). **Sixth Annual Report of the Department of Plant Pathology for the Year ending September 30th 1929.**—*Pamph. Seale-Hayne Agric. Coll.*, no. 31, 28 pp. Newton Abbot, Devon, 1930.

Notes are given on the prevalence of a variety of pests in Devon and Cornwall during the season 1928–29. Those observed on fruit trees included *Tortrix ribeana*, Hb., *T. podana*, Scop., *T. forsterana*, F., *Argyroploce* (*Penthina*) *variegana*, Hb., and *Parornix* (*Ornix*) *petiolella*, Frey, the damage caused by these moths to apple, pear and plum being considerably greater than usual.

A very brief account is given of the bionomics of the Criocerid, *Lema melanopa*, L., on cereals [*R.A.E.*, A, xvii, 502], and of *Aleurodes brassicae*, Wlk. (cabbage whitefly). Very little is known about the life-history of the latter and the possibilities of controlling it. It breeds freely in the late summer and autumn, but eggs and immature stages may be found throughout the year. It only occurs on *Brassica*,

no species of which is immune, though cabbage and brussels sprouts are preferred. Wild plants of this genus are a permanent source of infestation. The losses sustained are seldom due to the damage caused by the insect directly, but the presence of multitudes of adults that continue to emerge from pupae on the leaves after the plants have been cut sometimes renders the crop unsaleable. The Eulophid, *Encarsia partenopea*, Masi, a parasite of *Trialeurodes vaporariorum*, Westw. (greenhouse whitefly) attacked *A. brassicae* under artificial conditions, but so far no parasite of the latter has been found in the open. It is possible that the fumigation or spraying of young cabbage plants previous to setting in the field might reduce attacks sufficiently to render them negligible.

A list is given of insects not recorded in the five preceding years or occurring on food-plants not previously recorded. They include *Oscinella frit*, L., on barley; *Blitophaga opaca*, L., on potato, field peas and mangels; *Gortyna* (*Hydroecia*) *micacea*, Esp., on potato; *Ceuthorrhynchus assimilis*, Payk., the larvae of which destroyed ripening seed of broccoli; *Cladius pectinicornis*, Fourcr., on strawberry; *Pulvinaria vitis* var. *ribesiae*, Sign., on currant; *Tetranychus telarius*, L., which severely infested strawberry, ornamental plants and *Pyrethrum cinerariaefolium*; a Collembolan, *Orchesella* sp., which damaged the leaves and fruit of peach; and *Chermes piceae*, Ratz., on spruce.

ANDERSON (J.). **Isle of Wight Disease in Bees. I-II.** *Bee World*, xi, nos. 4 & 5, pp. 37–42, 50–53. Camberley, Surrey, April & May 1930.

The author discusses the hypothesis of immunity in regard to the Isle of Wight disease of bees. He has found that some bees are tolerant of the presence of the mite, *Acarapis woodi*, Rennie, and may harbour it without showing any symptoms of the disease. His hypothesis is that in time the bees in Britain will become so adapted to the presence of the mite that symptoms of the disease will be evident only in the more susceptible stocks during periods of stress.

DIEUZEIDE (R.). **Sur la présence de la mouche des fruits** (*Ceratitis capitata* **Wied.**) **en Gironde.** —*Rev. Zool. agric. appl.*, xxviii, no. 12. pp. 183–186, 1 fig., 4 refs. Bordeaux, December 1929.

Brief notes on the history and distribution of *Ceratitis capitata*, Wied., in France are given [*cf. R.A.E.*, A, xvii, 285]. A heavy infestation of a late variety of peach occurred in September 1929 near Bordeaux, infested fruit containing as many as 9 larvae. The fly has probably been introduced in fruit imported from Spain or Algeria, and its presence is a menace to the fruit-growing industry in the Garonne valley.

MORRIS (H. M.). **A Survey of Olive Pests.**—*Bull. Dept. Agric. Cyprus*, Ent. Ser. no. 2, 10 pp., 4 figs. Nicosia, March 1930.

Observations carried out in 1928 and 1929 on the insects attacking olive in Cyprus showed that *Dacus oleae*, Gmel. (olive fly) and *Prays oleellus*, F. (olive moth) were the most serious pests. The falling of the fruit is largely due to the larvae of *P. oleellus*, which emerge at or

near the point of attachment of the fruit to the stalk, but the most serious damage is caused by the larvae of *D. oleae*, which tunnel through the flesh and induce decay. Of the olives on the trees, the average percentage attacked by *D. oleae* was 17·2 and by *P. oleellus* 2·1, whereas among the fallen olives the figures were 35·3 and 43·5 respectively. Scars caused by the feeding of the adults of *Rhynchites ruber*, Fairm. (olive weevil) occurred on an average of 3·1 per cent. of the olives on the trees and on 6·3 per cent. of those on the ground, but the injury was only serious in a few localities. Other minor pests were a Cecidomyiid, which causes damage similar to that due to *D. oleae*, and a Coccid, *Leucodiaspis riccae*, Targ. The fruit of wild olives was found to be severely infested by *D. oleae*.

SCOTT (H.). **Biological Note on the South African Beetle** *Urodon lilii*, **Fåhraeus.**—*Proc. Ent. Soc. Lond.*, iv, pt. 2, pp. 99–100. London, 31st December 1929.

Several adults of *Urodon lilii*, Fåhr., a widespread South African beetle, were bred at the end of March 1929 from the seed-vessels of *Watsonia* sp. (Iridaceae) collected in February of the same year in the Orange Free State at an altitude of over 6,000 feet. This is apparently the first record of the food-plant of any South African species of *Urodon*. Opinions as to the systematic position of the genus, which is uncertain, are briefly reviewed. The Palaearctic species, so far as is known, are confined to plants of the orders Cruciferae and Resedaceae.

SCOTT (H.). **A new East African Species of** *Urodon* (**Coleoptera**) **bred from** *Gladiolus*, **with Notes on the Biology of the Genus.**—*Ent. Mon. Mag.*, lxvi, pp. 104–109. London, May 1930.

Urodon gladioli, sp. n., the adult and larva of which are described, with notes on its biology as observed in the laboratory, was found breeding in the seed capsules of *Gladiolus quartinianus* at an altitude of about 6,000 feet in Kenya. A list of the Palaearctic species of this genus is given with their food-plants.

HUSSAIN (M. A.). **Entomology.**—*Rep. Dept. Agric. Punjab 1928–29*, pt. I, pp. 53–63. Lahore, 1930.

The work carried out in the Punjab during the year 1928–29 is briefly reviewed. Light-traps were used with success against kutra moths [*Amsacta*], and the author considers that if organised and concerted action were taken over an entire infested area, the pest could be economically controlled. It was found that differences in temperature are responsible to a large extent for the abundance of the pink bollworm [*Platyedra gossypiella*, Saund.] in the south-eastern and eastern parts of the Province and for its comparative scarcity in the canal areas and further west. It was also found that the resting larvae in stored cotton seed are destroyed by exposure to the sun, and as the main emergence of the adults occurs in June, July and August, exposing the cotton seed to the sun during April and May would provide a cheap and simple method of reducing the numbers of the moth in the field. An investigation on the influence of temperature and humidity on *Dysdercus cingulatus*, F. (red cotton bug) showed that the optimum temperatures for its development were between 70 and 95° F., with a

humidity between 40 and 100 per cent.; the climatic conditions believed to have been responsible for partial failures of the cotton crops adversely affect the multiplication of the bug.

Pyrilla migrates to a new sugar-cane crop either directly from an old one still standing or indirectly from cereals or grasses, which it attacks on leaving the cane. The planting of late-ripening varieties of cane and the practice of ratooning and allowing crops to remain too long in the field encourage an increase of the pest. In the early stages it may be collected with sweep nets. In rice-fields infested with *Schoenobius bipunctifer*, Wlk., it was found that 99 per cent. of the borers may be killed by ploughing after harvest to expose the stubble to the sun, and 100 per cent. may be killed if the stubble is subsequently collected and burnt. Burning the standing stubble without ploughing was not effective, as a fairly large number of larvae survived.

Aspidiotus (*Comstockaspis*) *perniciosus*, Comst., which attacks apples, pears and similar fruit trees in hilly districts, is recorded from various localities. Serious damage was done to revenue records by the Anobiid, *Gastrallus indicus*, Reitt. (book beetle).

SHARANGAPANI (S. G.). **Entomology.**—*Ann. Rep. Dept. Agric. Bengal 1928–29*, pp. 36–37. Calcutta, 1929. [Recd. 1930.]

Brief notes are given on a number of injurious insects occurring in Bengal during 1928–29. Mangos were attacked by *Cryptorrhynchus gravis*, F., and *Dacus* (*Chaetodacus*) sp., against both of which the infested fruits were destroyed. Serious outbreaks of *Argyria tumidicostalis*, Hmps., were first observed in June 1928 on mature sugar-cane and cane planted the previous November; by destroying the former, cutting out dead hearts and regular thrashing, the moth was held in check, and the infestation was much reduced in 1929. Adults, nymphs and egg-clusters of *Pyrilla aberrans*, Kby., were numerous on the lower surface of sugar-cane leaves in one locality. Beating the infested leaves with brooms and subsequent spraying with a phenyl solution, 1 : 166, gave good control. During the colder months of the year rice was attacked by the larvae of *Spodoptera mauritia*, Boisd., which migrated to the seed-beds from neighbouring grass areas. The infestation was held in check by digging trenches on the sides of the seed-beds and treating the cracks in the soil, in which the larvae hide during the day, with kerosene and water, 1 : 20. The uninfested rice bordering the trenches was sprayed with lead chromate, 1 oz. to 2 gals. water. Immature stages of *Hieroglyphus banian*, F., were found in the tall grass bordering the rice-fields. Miscellaneous pests included *Phenacoccus hirsutus*, Green, on mulberry; *Diacrisia obliqua*, L. (jute semi-looper); *Aleurocanthus* (*Aleurodes*) *nubilans*, Buckton, on betel-vine [*Piper betle*], which was controlled by a spray of 1 lb. soap, $\frac{1}{8}$ pt. phenyl and 2 gals. water; and *Danais chrysippus*, L., on *Asclepias*, which was destroyed by several applications of a spray of lead chromate, 1 oz. to 2 gals. water. Fumigation of cigars and stored tobacco with carbon bisulphide was carried out against *Lasioderma serricorne*, F.

LESNE (P.). **Diagnoses de Bostrychides nouveaux (Col.).**—*Bull. Soc. ent. Fr.*, 1930, no. 5, pp. 102–104. Paris, 1930.

The species described are *Prostephanus apax*, sp. n., from southern Arizona in the wood of *Thurberia thespesioides*, and *Sinoxylon malaccanum*, sp. n., from Malaya in the roots of *Derris* sp.

TILLYARD (R. J.). **The Biological Control of Noxious Weeds.**—*Pap. Proc. R. Soc. Tasmania 1929*, pp. 51–86, 8 pls., 1 fig., 38 refs. Hobart, 19th March 1930.

This paper provides a complete summary of the work done up to the present time in the control of noxious weeds by biological methods in Australia and New Zealand, with a brief note on the early history of the subject in Hawaii. An account is given of the general principles of the methods used, the theoretical risk taken in introducing the insect enemies of any particular plant and the practical means used to eliminate that risk. The biological control of the prickly pear (*Opuntia* spp.) in Australia, which is described, may be regarded as the one scientific method of dealing with this noxious plant with an expenditure lying within reasonable limits of national finance, and the present prospects of ultimate control of the plant, at least to negligible proportions, are considered extremely good [*cf.* *R.A.E.*, A, xviii, 287]. The work of the Cawthron Institute in New Zealand is outlined. In the few years since this work was inaugurated, one insect, the cinnabar moth, *Tyria jacobaeae*, L., has become successfully acclimatised, and its value against ragwort [*Senecio jacobaea*] will gradually be determined [*cf.* xvii, 733]. Research with two other promising species, namely, *Coraebus rubi*, L., on blackberry, and *Apion ulicis*, Forst., on gorse [*Ulex europaeus*] [xvi, 534, 540], is at present hindered owing to the development of infertility in the females after acclimatisation in New Zealand. In Australia, where some of the problems are practically identical with those in New Zealand, research is also being conducted on the insect enemies of a number of other weeds, and the work being carried on at the Laboratory at Canberra is briefly outlined.

NEWMAN (L. J.). **The Red-legged Earth Mite** (*Penthaleus destructor*).—*J. Dept. Agric. W. Aust.*, (2) vii, no. 1, pp. 115–118. Perth, W. A., March 1930.

This account of *Penthaleus destructor*, Tuck. (red-legged earth mite) and its control in Western Australia is very similar to one already noticed [*R.A.E.*, A, xviii, 139]. Calcium cyanide dust will destroy the mites ; it should not be applied to moist foliage, nor when there is any wind. Powdered naphthalene dusted around the plants acts as a repellent.

[**Reports of the**] **Bureau of Sugar Experiment Stations.**—*Queensland Agric. J.*, xxxiii, pts. 3 & 4, pp. 178–185, 247–250. Brisbane, 1st March & 1st April 1930.

An account is given by E. Jarvis of a serious outbreak of *Lepidoderma albohirtum*, Waterh., that occurred on sugar-cane in the Meringa District during January 1930. In many cases 20–30 beetles were counted on a single plant, and on badly infested areas the leaves were practically destroyed. As a rule, the beetles emerging from forest or cane lands fly to the nearest feeding trees, seldom eating or even resting on cane leaves. It is suggested that in this case they may have been weakened by the continued dry weather and on emergence were forced to feed on cane leaves to gain sufficient strength to enable them

to fly. If, however, the outbreak did not arise from a local infestation in the previous year, it might be accounted for by migration from extensive breeding grounds in forest areas.

A. N. Burns reports that the death of numerous small cane shoots in the Oakenden district was due to the larvae of *Rhyparida limbatipennis*, Jac., which enter the basal part of the shoots below ground level and eat out the interior for the length of an inch or more. One larva is evidently capable of destroying several shoots. The larva, pupa and adult are described. Many of the grubs may be removed by cutting out as low down as possible those shoots that are just beginning to wither. The removal of dead shoots is useless, as the larvae do not remain in them.

R. W. Mungomery reports that in the autumn, when planting is being carried on, a certain amount of injury is caused by mole-crickets (*Gryllotalpa*) eating into the centre of young cane shoots and producing dead hearts. Their presence in a field can be ascertained by their burrows, which disturb the surface of the soil. Eggs are laid throughout the spring months in an earthen chamber at a depth of about 8 ins. and hatch about a month later, so that the adults are present in large numbers during the summer and autumn. Sugar-cane should not be planted in fields that have recently been under grass, particularly in damp areas. Wet fields should be well drained and the cane planted with a minimum covering of soil, so that a strike is secured as soon as possible. Crude naphthalene placed in the soil near the plant is said to be a satisfactory repellent, and although it slightly retards germination, it has no injurious effect on the development of growing cane.

Owing to the unusually wet weather, fumigation against the larvae of *L. albohirtum* has been in many cases unavoidably delayed until about the end of January. E. Jarvis points out that young plants from 18 to 30 ins. high, growing on well-drained land, can often be successfully fumigated by using crystals of paradichlorobenzene, for although volatilisation may be temporarily checked by showers of rain, it re-commences as soon as the excess water has drained away. Hand-collection of the beetles is also advocated.

WEDDELL (J. A.). **Field Notes on the Banana Fruit-eating Caterpillar** (*Tiracola plagiata* **Walk.**).—*Queensland Agric. J.*, xxxiii, pt. 3, pp. 186–201, 4 pls., 20 refs. Brisbane, 1st March 1930.

During March 1927, bananas, maize, pumpkins and other crops in the southern coastal districts of Queensland were severely damaged by the larvae of the Noctuid, *Tiracola plagiata*, Wlk. The crops mentioned were the principal food-plants, probably because of the comparatively large area covered by them. On banana, the young larvae feed on the surface of both leaves and fruit and the older larvae eat the leaves and burrow into the pulp. Most of the losses were due to the unsightly scars on the fruit, one young larva injuring a number of fingers in this way. Feeding occurred chiefly on those parts of the bunch exposed to bright light. On maize both foliage and grain were attacked, and practically every cob was affected. Pumpkins growing between the rows of maize were almost defoliated, and all parts of the fruit, including both the tough rind and the seeds, were devoured. Lists are given of the other cultivated and wild plants attacked in Queensland and of the food-plants recorded for other parts

of the world. Eggs were found, generally singly, on the leaves of ink-weed (*Phytolacca octandra*), which is probably the important primary food-plant. The caterpillars migrate readily and in heavy infestations may be found on the ground, on the trunks of trees, on the stems of herbaceous plants, etc. Pupation takes place in an earthen cocoon an inch or two below the surface of the soil, often partly sheltered by a loose stone, stick or log. A number of Hymenopterous larvae and pupae were found in the same situations as the pupae of *T. plagiata*, in some cases actually enclosed in the earthen cocoon of the moth. From these were bred, among other species, a number of individuals of the Ichneumonid, *Paniscus testaceus*, Grav.

In preliminary experiments, dusting was found to be impracticable on bananas, as the dust failed to adhere to the smooth surface of the leaves. A bait, made by mixing 1 lb. Paris green with 50 lb. bran and adding 1 qt. molasses or treacle, the juice of 2 oranges and about 2 gals. water, was fairly effective. The caterpillars made no attempt to penetrate bags made of a kind of cheesecloth woven in tubular form that were used to cover the bunches of bananas. As it seems probable that the outbreak originated in and near scrub land, particularly on inkweed, it is recommended that a strip of ground between scrub and planted areas should be kept free from weeds. The scrub should be examined at intervals, and if caterpillars appear to be prevalent, poison bait should be scattered along the cleared strip and over several adjacent rows of bananas. Should the caterpillars spread into the plantation, the whole area should be treated with bait.

Temperley (M. E.). **Life History Notes on the Banana Fruit-eating Caterpillar** (*Tiracola plagiata* **Walk.**).—*Queensland Agric. J.*, xxxiii, pt. 4, pp. 251–261, 2 pls. Brisbane, 1st April 1930.

An account is given of studies on *Tiracola plagiata*, Wlk. [see preceding paper] carried out in the laboratory at Brisbane. Owing to the failure to obtain fertile eggs from moths reared under artificial conditions, only one generation was completed. All stages of the moth are briefly described. The average length of life was 13 days for females and 8 for males. Oviposition took place at night or in the early morning, the eggs being deposited indiscriminately, although leaves of inkweed [*Phytolacca octandra*] were growing in the cage. An average period of 7 days elapsed between the emergence of the females and the deposition of the first eggs. In the majority of cases eggs were laid daily until the death of the female; the largest number laid by a single moth was 2,398. The average incubation period during June was 8–9 days, the average minimum and maximum temperatures being 61 and 67° F. respectively. The newly hatched larva, after eating its egg-shell, does not feed for about 24 hours, but wanders about. When disturbed, it drops from the leaf by a silken thread, and it is possible that in nature the young larvae are dispersed by the wind. They are positively phototropic [*loc. cit.*] and collected in large numbers on the side of the breeding jar nearest the light. Young larvae were placed on inkweed, milk-thistle [*Sonchus oleraceus*] and banana leaves, and although they fed readily on the first two, they failed to thrive on banana, a fact that indicates a possible migration of the older larvae to banana in the field. The larvae feed for an average period of 45 days, after which they descend to the soil. The prepupal period lasts 6–10 days and the pupal period averages 29.

The Ichneumonids, *Lissopimpla semipunctata*, Kirby, and *Paniscus testaceus*, Grav., were bred from the pupae, and adults of these species were also observed to be active in the field where infestation by *T. plagiata* was severe. The Eulophid, *Euplectrus kurandaensis*, Gir., was found attacking the larvae of the third or fourth instar. The eggs, which were scattered in groups over the dorsal surface of the host, hatched in 4 days, and the young larvae attached themselves in the region of the thorax, where they began to feed. When the host died, the larvae migrated to the ventral surface, where they attached themselves preparatory to pupating. The larval stage lasted 4 days and the pupal 7.

WOODHILL (A. R.). **The Green Peach Aphid** (*Myzus persicae*). **Progress Report on Spraying Experiments.**—*Agric. Gaz. N.S.W.*, xli, pt. 4, pp. 311–314, 2 figs. Sydney, April 1930.

This is a brief account of field and laboratory experiments carried out in July–September 1928 and 1929 in the Murrumbidgee Irrigation Area, N.S.W., on the control of *Myzus persicae*, Sulz., a severe outbreak of which occurred there on peach in 1926. Short notes on the life-history of the pest are given [*cf. R.A.E.*, A, xvi, 362]. Of the various sprays tested, tar distillate at a strength of 1 : 25 killed all the over-wintering eggs, and nicotine sulphate applied soon after they had hatched at the rate of 1 : 600 with the addition of soft soap (1 lb. to 25 gals. water), gave complete control, only one application being necessary with either of these substances. It is essential to apply the sprays at the correct time, which for tar distillate is from about the last week in June to mid-July, when all the eggs have been deposited and before they have hatched, and for nicotine sulphate from about 1st to 25th August, after all the eggs have hatched but before the buds burst. The tar distillate caused slight damage to the trees and killed a certain percentage of the buds, but it is considered likely that a strength of 1 : 30 or 35 will still give control without injuring the trees. None of the dusts tried proved satisfactory.

WILLARD (H. F.), MASON (A. C.) & FULLAWAY (D. T.). **Susceptibility of Avocados of the Guatemala Race to Attack by the Mediterranean Fruit Fly in Hawaii.**—*Hawaii. For. Agric.*, xxvi, no. 4, pp. 171–176. Honolulu [1930].

The susceptibility to infestation by *Ceratitis capitata*, Wied., of West Indian avocados, which ripen during the summer in Hawaii and have a thin skin, has necessitated a quarantine against the importation of avocados grown in Hawaii into the United States. The Guatemalan varieties usually have a thick, woody skin and ripen during the winter, which has led to the belief that they are immune from attack by the fly. Experiments were therefore undertaken from 1925 to 1929 to determine the advisability of modifying the quarantine regulations as regards these varieties. When fruits were placed in cages each containing 150–250 adult flies, about half of which were females, only 2·2 per cent. were infested. This low percentage of infestation under conditions of concentrated attack shows that the Guatemalan forms have a high degree of resistance. When 35–45 flies were enclosed in cylindrical cages placed over fruits on the trees, only 1·3 per cent. were

attacked. Finally, fruit in the same condition as that harvested for market was kept in the laboratory until ripe, and it was then cut open and examined. Out of a total of 1,269 fruits, 5 or 0·4 per cent. were infested. Four of the five infested fruits were in perfect condition, only one having a crack in the skin. Moreover, some of the thickest skinned of the Guatemalan varieties were attacked in the cage tests, and fruit was also infested in an unripe condition, 10–11 days before it was fit for consumption. From these facts it is concluded that commercial shipments of Guatemalan avocados from Hawaii might harbour *C. capitata.*

Whitney (L. A.). **Report of Associate Plant Inspector, December, 1929.**—*Hawaii. For. Agric.*, xxvi, no. 4, pp. 199–200. Honolulu [1930].

During inspection work in December, persimmons, tangerines and oranges from California were found to be infested with *Heliothrips fasciatus*, Perg. (bean thrips), and the greater part of the 2,770 parcels refused admittance were rejected on account of this pest. A suggested explanation is that the mild, dry, climatic conditions that prevailed on the coast of California during the season enabled the thrips to remain active long after the beginning of the normal hibernating period, and that when the weather conditions returned to normal, they were forced to migrate to the fruits in the field for protection. Such an occurrence has never been observed before nor has this species been recorded in Hawaii.

Tucker (R. W. E.). **Report of the Entomologist.**—*Rep. Dept. Sci. Agric. Barbados 1928–29*, pp. 79–84. [Bridgetown] 1930.

Notes are given on the economic importance of *Diatraea saccharalis*, F., and *Diaprepes abbreviatus*, L., on sugar-cane in Barbados, and on the breeding of *Trichogramma minutum*, Riley, for the control of the former [*R.A.E.*, A, xvii, 356, 614]. It is concluded that the introduced larval parasites of *D. saccharalis*, *Ipobracon grenadensis*, Ashm., and *Microdus* sp., have failed to become established, since during a careful survey beginning in September 1928 and lasting 8 months, no adults were found on *Cordia* bushes, on which they depend for their food-supply, and none of the borer larvae from cane in the field was parasitised. The results obtained with light-traps, consisting of electric light bulbs suspended over shallow trays containing water with a film of oil, show that their use for protecting sugar-cane seedlings against *D. saccharalis* is justified.

Experiments with soil fumigants, such as paradichlorobenzene and carbon bisulphide, against *Diaprepes abbreviatus* indicate that the soil and moisture conditions are unfavourable; moreover, the cost of materials is prohibitive. In examinations of badly infested stools of sugar-cane, as many as 96 larvae of *D. abbreviatus* and 4 of *Lachnosterna* (*Phytalus*) [*smithi*, Arrow] were found in a single hole. So far the main measure recommended for controlling the former is the intensive collection of the adults during the period of their emergence. Owing to the belief that *Tyrannus dominicensis vorax* feeds on *Tiphia parallela*, Smith, a parasite of *L. smithi*, the feeding habits of this bird were

investigated. The contents of the crops of 95 birds revealed only one individual of *T. parallela*, the majority of insects found including such pests as *Metamasius sericeus*, Ol. (cane weevil), *D. abbreviatus*, etc.

The main measures for effectively controlling *Platyedra* (*Pectinophora*) *gossypiella*, Saund. (pink bollworm) on cotton include the disinfection of imported cotton seed by heat and the close season and cultivation methods enforced by legislation. Disinfection of seed takes place 200 yards from the shore, in an off shore wind, and the vessels are subsequently fumigated with hydrocyanic acid gas. A consignment of the parasite, *Microbracon kirkpatricki*, Wlkn., which exerts an appreciable control over this moth in Kenya, was received through the Imperial Institute of Entomology in May 1929, but attempts to breed it in the laboratory appear to have failed.

MacAloney (H. J.). **The White Pine Weevil** (*Pissodes strobi* **Peck**).—**Its Biology and Control.**—*Bull. N. Y. St. Coll. Forestry*, iii, no. 1 (Tech. Pub. no. 28), pp. 1–87, 13 pls., 1 fig., 7 graphs, 8 pp. refs. Syracuse, N.Y., February 1930.

The greater part of the information contained in this account of the biology and control of *Pissodes strobi*, Peck (white pine weevil) in the north-eastern United States and the Canadian Provinces of Nova Scotia and New Brunswick is similar to that already noticed [*R.A.E.*, A, xviii, 416, etc.]. With regard to the effect of soil on infestation [xv, 407], the author now states that pines on medium agricultural (sandy loam) soils will generally show the greatest injury and be most frequently attacked, because the growth is more vigorous and consequently the leaders are more attractive to the beetles. Stands on light sandy soils may contain as many infested trees to the acre, but the ultimate injury is not so severe. In a discussion on the natural enemies of the weevil, the author points out that the two parasites most common throughout its range are *Eurytoma pissodis*, Gir., and *Lonchaea corticis*, Taylor, previously recorded [xv, 407] as *L. laticornis*, Mg. *Microbracon pini*, Mues., is very prevalent throughout Massachusetts and Connecticut. Observations carried out in the summer of 1927 in several localities in Nova Scotia and New Brunswick showed that in many cases nearly 100 per cent. of the larvae were parasitised, mainly by *E. pissodis* and *L. corticis*. Larvae found in association with weevil larvae in infested leaders were subsequently identified as those of *Muscina stabulans*, Fall., and the author considers that this fly is a primary external parasite of *P. strobi*. It is concluded that the cost of breeding and liberating parasites and predators in sufficient numbers to produce any appreciable effect would be too great to make such a project financially practical over a wide area.

Collins (D. L.) & Nixon (M. W.). **Responses to Light of the Bud Moth and Leaf Roller.**—*Bull. New York Agric. Expt. Sta.*, no. 583, 32 pp., 23 figs. Geneva, N.Y., February 1930.

During the summer of 1929 further experiments were carried out with electric light traps [*R.A.E.*, A, xvi, 205] in an apple orchard in western New York. The traps used were similar to those already described [xvi, 206], a clear glass 75 watt lamp being employed, and were suspended by means of screw-eyes from the lower limbs of the trees,

5–6 ft. above the ground. One was hung from each of 105 trees on a 4-acre section of the orchard, the pans being filled with water alone.

The traps were operated from 15th June to 26th August, the lights being turned on about 8 o'clock at night and off shortly after 5 in the morning, and 27,726 adults of *Eucosma ocellana*, Schiff. (bud moth) and 16,432 of *Tortrix* (*Archips*) *argyrospila*, Wlk. (fruit-tree leaf-roller) were caught, besides numerous other insects, of which the more important are listed. *E. ocellana* was taken from 18th June onwards and *T. argyrospila* from 23rd June to 5th August, the maximum flight of both moths occurring on 7th July. Dipterous and Hymenopterous parasites were not numerous in the traps, only 1,895 individuals being captured during the season. In the case of Lepidoptera, flight was definitely inhibited when the temperature fell below 60° F., the moths being most active when it ranged between 65 and 70° F. The largest numbers of moths were caught in the outer rows of traps, a possible explanation being that the comparatively large unlighted area acted as a source of supply. Injury by *E. ocellana* to the leaf clusters was from 8 to 26 per cent. greater in the unlighted part of the orchard than in the lighted section, and from 2 to 7 times as many moths were present in unlighted trees. Males and females were caught in about equal numbers, and few of the females had laid their eggs. The numbers of *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth) captured were very small, and observations indicated that infestation was low in all sections of the orchard.

Notes are given on the life-history of *E. ocellana* [xvii, 270] and *T. argyrospila*. The eggs of the latter are laid in June or July in masses on the twigs, branches and trunks of the apple trees. The larvae hatch in the following spring and feed on the opening buds. Later they web the young leaves together, sometimes including the young fruit, and after feeding for about a month, pupate, usually in the rolled leaves. The pupal period generally lasts about 10 days.

CROSBY (C. R.) & BLAUVELT (W. E.). **A European Beetle found in New York (Coleop.: Curculionidae).**—*Ent. News*, xli, no. 5, p. 164. Philadelphia, Pa., May 1930.

A few individuals of *Cleonus piger*, Scop., were found among stored beans from a farm in New York. From enquiries it was found that they had been brought into the barn with the crop, numbers of the weevils having been observed on piles of bean vines in the fields. It is thought that their association with the beans was accidental and that they were merely seeking hibernating quarters. *C. piger* is a pest of sugar-beet in central Europe, other food-plants being *Carduus* and *Cirsium*.

BURKE (H. E.). **Monterey Pine Midge pupates at Bases of Needles.**—*Pan-Pacific Ent.*, vi, no. 4, p. 147. San Francisco, Cal., April 1930.

A study of *Thecodiplosis piniradiatae*, Snow & Mills, has shown that pupation occurs in papery cocoons in hollowed out cells at the bases of the pine needles, usually beneath the scales that form the sheath, and not in the soil as has often been stated in the literature. Pupae were occasionally found between the sheaths.

Flanders (S. E.). **Notes on** *Trichogramma minutum*.—*Pan-Pacific Ent.*, vi, no. 4, pp. 180–181. San Francisco, Cal., April 1930.

When newly deposited eggs of the orange tortrix [*Tortrix citrana*, Fern.] were parasitised by *Trichogramma minutum*, Riley, and kept in an incubator at 80° F., adult parasites emerged 8–9 days later. The larvae from uninfested eggs hatched at the same time. One female parasite oviposited eight times within 15 minutes. Less than 7 hours later the movement of the newly hatched larvae was observed inside the host eggs, and about 48 hours later they were full-grown. The parasites are seldom able to complete their development in eggs that are parasitised after the embryo is about three-fifths developed. The emerging parasite cuts an exit hole on the side exposed to the strongest light.

Strains of *T. minutum* from different localities may exhibit marked differences in fecundity and in the retention of pigmentation when reared under the same conditions [*cf. R.A.E.*, A, xviii, 369]. Females from Yucaipa, California, a hot dry locality, lose their pigmentation when reared at room temperatures; those from Saticoy, a cool humid one, lose it at higher temperatures; and those from El Dorado, Mexico, a hot, humid district, retain it at all temperatures. The two Californian strains interbreed freely. Attempts to cross them with that from Mexico, however, have been unsuccessful; mating occurs but the progeny is male. The difference in fecundity of the females of these strains when confined with eggs of *Sitotroga* [*cerealella*, Ol.] also varied, being decidedly low in the Yucaipa strain and very high in the Mexican one.

When the eggs of *Ephestia cautella*, Wlk., are parasitised and then submerged in water for a week at 85° F., the parasites live and develop normally up to the late pupal period, showing that their oxygen requirements are low.

Cotton (R. T.). **The Effect of Light upon the Development of the Dark Meal Worm,** *Tenebrio obscurus* **Fab.**—*Proc. Ent. Soc. Wash.*, xxxii, no. 4, pp. 58–60, 1 pl. Washington, D.C., April 1930.

Under favourable conditions, larvae of *Tenebrio obscurus*, F. (dark mealworm) hatching in the spring or early summer months become apparently fully grown by mid-August, but do not transform until the following spring. If, however, the larvae are kept in a heated room, some may pupate in November or December. Continuous exposure of the larvae to artificial light, from the latter part of August, considerably accelerated their development, five of them pupating within a month.

Ries (D. T.). **The Iris Borer.**—6 pp. multigraph. State College, Pa., Pennsylvania Sch. Agric. Expt. Sta., Div. Agric. Extens. [1930.]

An account is given of the bionomics and control of *Macronoctua onusta*, Grote (iris borer), which has lately become a serious pest in the commercial iris-growing areas in Pennsylvania [*cf. R.A.E.*, A, xvii, 39, 197, 718].

Painter (R. H.). **A Study of the Cotton Flea Hopper,** *Psallus seriatus* **Reut., with especial Reference to its Effect on Cotton Plant Tissues.**—*J. Agric. Res.*, xl, no. 6, pp. 485–516, 7 figs., 12 refs. Washington, D.C., 15th March 1930.

The spread through the southern United States of a peculiar form of injury traceable to *Psallus seriatus*, Reut. (cotton flea-hopper) has been rapid, although the insect itself has been known to be present there for some time. The generalised effect of its attack on the cotton plant suggests the presence of other factors in addition to simple feeding. During the summer of 1925 an investigation was made of the possibility of the transmission of a plant disease by this Capsid.

The following is largely taken from the author's summary: The anatomy and histology of the alimentary canal of *P. seriatus*, the structure of the salivary glands, mouth-parts, etc., and the presence of bodies that may be parasites in the anterior part of the salivary glands are discussed. The effect of the feeding of *P. seriatus* on the plant cells is described; a study of the tissues of infested cotton shows, in addition to malformations of the cells, the presence of cell inclusions near the site of the puncture. In certain preparations these cell inclusions have the appearance of an invading or developing parasite. So far as the transference of material by the insect from plant to plant is concerned, experiments with vital dyes were negative. Observations suggest the possible presence of an organism, which is transmitted by *P. seriatus* and *Lygus pratensis*, L., that does not penetrate far from the point of introduction.

Field experiments show that the material injected by *P. seriatus* does not spread far from the point of injury. So far as was visible externally, plants showed a complete recovery from the effects (split lesions with swellings) of all inoculations with crushed hoppers, etc., except in the region of the lesions, which did not develop further. The appearance of a systemic disturbance sometimes observed in infected fields, therefore, seems to be due to the multiplicity of bites, and the shedding of squares seems to be due to a bite nearby.

Porter (B. A.) & Sazama (R. F.). **Influence of Bordeaux Mixture on the Efficiency of Lubricating-oil Emulsions in the Control of the San José Scale.**—*J. Agric. Res.*, xl, no. 8, pp. 755–766, 4 figs., 8 refs. Washington, D.C., 15th April 1930.

An account is given of experiments undertaken from 1923 to 1928 to test the comparative efficiency of oil emulsions in combination with Bordeaux mixture against *Aspidiotus perniciosus*, Comst. (San José scale) in summer treatment of apple and dormant season treatment of peach trees.

Lubricating-oil emulsion was found to be reduced in efficiency when Bordeaux mixture was added at the usual strengths (2–3–50 to 4–6–50). This reduction appeared with dormant sprays of low concentrations of oil and practically disappeared under the conditions of these experiments when the oil content reached 1·5 per cent. [*cf. R.A.E.*, A, xv, 423]. In summer spraying it is very marked with oil concentrations, up to 2 per cent. The authors believe that the Bordeaux mixture acts in a mechanical way by absorbing a certain volume of oil and thus preventing its penetration into the insect. It is therefore recommended that the oil content of an emulsion for dormant spraying should be

moderately increased whenever Bordeaux mixture at full strength is to be added, and that emergency applications of oil in summer should be made separately and not in combination with one of the regular Bordeaux sprays.

Isely (D.). **The Biology of the Bean Leaf-beetle.**—*Bull. Arkansas Agric. Expt. Sta.*, no. 248, 20 pp., 10 figs., 10 refs. Fayetteville, Ark., February 1930.

The Galerucid, *Cerotoma trifurcata*, Forst. (bean leaf-beetle) is extremely destructive in Arkansas to the vegetative parts of beans, cowpeas and soy-beans, and also lives on various weeds. The eggs are deposited in the soil near the food-plant and the larvae attack the roots and nodules. When full-grown, the larva forms an oval cell in the earth, from one to four inches below the surface, where the pre-pupal and pupal periods are passed. The stages of the insect are described. The rate of development is largely influenced by temperature; at 85° F. the egg-stage averages 7 days, the larval 8·8, the pre-pupal 3·96 and the pupal 5, whereas at 69·8° F. these periods are all nearly twice as long. The beetles emerge from hibernation in April and early May, and only oviposit after feeding on the seedling stage of the food-plant. Adults of three generations were reared during these studies; it is thought possible that the number of generations occurring during a season is dependent upon the availability of seedling food-plants, which appear to stimulate oviposition, at the time of emergence from the soil. Most of the damage in Arkansas is caused by overwintered adults, those of the first generation, and larvae of the first and second generations. Relatively dry weather is favourable to the beetle, as is also an abundance of its most important wild food-plant, the quailpea (*Strophostyles helvola*), but it occurs in numbers even in unfavourable seasons. The Tachinid, *Celatoria diabroticae*, Shim., has been reared in small numbers from *C. trifurcata*, but is not sufficiently numerous to affect its abundance. Injury may be largely prevented by dusting the seedlings with arsenicals; two applications of calcium arsenate and hydrated lime, 1 : 10, gives good protection to beans, acting chiefly as a repellent. The planting of cowpeas in late May and early June (or earlier in the more southern parts of the State), so that they will have passed the seedling stage before the second generation adults appear, would do much to obviate injury.

Compton (C. C.). **Greenhouse Pests.**—*Ent. Circ. Illinois State Nat. Hist. Survey Div.*, no. 12, 112 pp., 34 figs. Urbana, Ill., 1930.

The general insect problems arising in the cultivation of flowers and ornamental plants under glass in Illinois and the principles underlying attempts to solve them are discussed, and the insect pests are dealt with at some length under the heading of the plant on which they are normally most destructive. The descriptions of the injury done by each pest, its life-history and habits, and the control measures practised against it are based on the results of investigations carried on during the past seven years in the State. A section deals with fumigants, insecticides and apparatus and contains directions for the application of control measures. Indices to the plants and the popular names of the pests are included, the scientific names being given in footnotes.

FLINT (W. P.). **The Oriental Fruit Moth, Curculio and Codling Moth in Illinois in 1929.**—*Trans. Illinois Hort. Soc.*, lxiii, pp. 139–146. Centralia, Ill., 1930.

Notes are given on work against the oriental fruit moth [*Cydia molesta*, Busck] in Illinois during 1929. Its parasites are now sufficiently abundant in the heavily infested area of the southern part of the State to play some part in controlling it. It did not increase there during the season, and according to T. H. Parks, there was a slight decrease in Ohio.

In southern Illinois injury to peaches by the plum curculio [*Conotrachelus nenuphar*, Hbst.] has increased considerably during the past three years. Dusting and spraying recommendations for 1930 are given. It is not safe to apply more than 1½ lb. lead arsenate to 50 U.S. gals. spray on peaches, and 2 lb. lime should be used to each 1 lb. lead arsenate. The dust recommended is sulphur, lead arsenate and lime, 80 : 10 : 10. *C. nenuphar* has also increased in numbers in the apple growing districts of the western part of the State. In plots where 2 lb. lead arsenate to 50 U.S. gals. spray was applied according to a schedule already noticed [*R.A.E.*, A, xviii, 276], the damage by the weevil to apples was reduced to less than 10 per cent. as compared with untreated plots where the injury averaged 54 per cent.

The codling moth [*Cydia pomonella*, L.] was not quite so numerous in the early broods as it has been in some years, but there was a marked increase in the late broods. In some orchards more than the usual amount of fruit was infested ; this was probably due to the fact that the heavy late applications of the standard lead arsenate sprays could not be recommended on account of the spray residue situation. In experiments from early July to mid-September, no larvae sheltering under bands treated with standard beta-naphthol survived, and only 10 per cent. of those under bands treated with beta-naphthol dissolved in petrol before being added to the lubricating oil [*cf.* xvii, 722] produced adults. Approximately 50 per cent. of the larvae infesting a tree can be trapped under the bands. In connection with experiments with certain highly refined oils, etc., against the later broods of *C. pomonella* [see next paper], summaries of the results obtained with similar sprays in other States are given.

FARRAR (M. D.). **Oil Sprays for late Brood Codling Moth.**—*Trans. Illinois Hort. Soc.*, lxiii, pp. 147–154, 1 fig. Centralia, Ill., 1930.

This is a brief account of experiments in Illinois during 1927–29, in which certain summer oils at 2 per cent. strength proved satisfactory against the second brood of the codling moth [*Cydia pomonella*, L.] on apples, although they failed to give quite as effective control as lead arsenate. The addition of nicotine sulphate or derrisol, at the rate of 1 : 800, increased the efficiency of the emulsion. Further tests showed that these oils were not as efficient in controlling the plum curculio [*Conotrachelus nenuphar*, Hbst.] on apple as lead arsenate.

HARTMAN (H.). **The Removal of Spray Residue by the Washing Method.**—*Trans. Illinois Hort. Soc.*, lxiii, pp. 179–184. Centralia, Ill., 1930.

An account is given of the methods employed in removing spray residues from apples and pears by washing in dilute hydrochloric

acid. The washing solution is prepared by mixing 5–7 quarts of concentrated hydrochloric acid (20° Bé) with 100 gals. water ; late in the season it is sometimes necessary to increase the acid to 10–12 quarts. The time necessary to clean the fruit varies with the type of machine. In the case of machines of the diffused spray or flood-wash principles, 30 to 50 seconds are usually sufficient. With machines of the flotation type, however, where no great amount of agitation is provided, from 4 to 5 minutes are often required. The importance of thoroughly removing the acid from the fruit after washing is pointed out. The best results are obtained by spraying or throwing water on the fruit. A spray of clean water as the fruit leaves the machine is of value in removing the last traces of the acid as well as such decay-producing spores as may still be attached to the fruit.

FLINT (W. P.) & CHANDLER (S. C.). **The Oriental Fruit Moth in 1929.**—*Trans. Illinois Hort. Soc.*, lxiii, pp. 430–441 & 445–446. Centralia, Ill., 1930.

An account is given of the situation regarding the oriental fruit moth [*Cydia molesta*, Busck] in Illinois, where it occurs throughout the commercial peach growing area, infestation ranging from 1 to 25 per cent. Adults of the overwintering generation appear about the time the trees are in full bloom. Larvae of the first three generations feed largely on the new twigs, and it is those of the fourth generation, which begin to appear at the end of July, that cause most of the injury to the fruit. The late fourth and the fifth generation larvae depend for their food-supply mainly on the late varieties of peach and apple, if they are available. If apple and peach are to be interplanted at all, the former should be an early maturing variety. Of a number of sprays tested, the best results were obtained with one consisting of 5 lb. hydrated lime, 1 lb. lead arsenate and 10 lb. talc that can be passed through a 300 mesh sieve, mixed with 1 per cent. by weight of refined oil, and 50 U.S. gals. water ; this reduced infestation by 50 per cent. The use of hydrated lime in excessive quantities (about 15–25 lb. to 50 U.S. gals. water) gave a very poor degree of control and left a large amount of residue on the fruit [*cf. R.A.E.*, A, xvii, 723 ; xviii, 388]. In dusting experiments it was found that the addition of 5 per cent. by weight of oil to the dusts increased their adhesiveness. In one plot dusted with a mixture of 90 lb. hydrated lime, 10 lb. lead arsenate and 5 per cent. of white oil, nine applications being made from the fall of the petals, infestation amounted to 5·1 per cent., as compared with 24·5 per cent. in the untreated plot.

GRAHAM (S. A.). **Ornithology and Forest Entomology.**—*Pap. Michigan Acad. Sci.*, xi, pp. 389–397, 1 fig. Ann Arbor, Mich., 1930.

During investigations on the effect of various environmental factors on the larch sawfly, *Lygaeonematus erichsoni*, Htg. [*R.A.E.*, A, xviii, 308], the influence of birds was studied to some extent in Minnesota, and the observations made are described in this paper. It is concluded that the effect of birds in this case is relatively slight, because the larvae are usually found on the slender, flexible twigs at the tips of the branches, whereas even small birds prefer the more substantial twigs and branches. It seems highly probable, however, that birds might be extremely

useful in reducing the numbers of insects under other circumstances, their effectiveness being directly proportional to the accessibility of their prey.

Bryson (H. R.). **A Study of Field Practices as related to Wireworm Infestations (Elateridae).**—*J. Econ. Ent.*, xxiii, no. 2, pp. 303–315, 1 ref. Geneva, N.Y., April 1930.

The following is taken from the author's summary: Studies of the injury caused by wireworms to maize grown on land subjected to various farming practices were carried out in Kansas from 1924 to 1929 and indicate that the severity of infestations is influenced by the various methods employed. A perceptible increase in injury was evident in the rate of planting experiments when the plants were spaced 20 inches or more apart. This fact also held true for the rate and date of planting tests started in 1929, the injury being greater to maize planted on 2nd May than to that planted on 18th May. The date and method of planting experiments showed a greater injury to maize planted between 31st March and 10th May than to that planted later. Listed maize (over which the soil is thrown in the form of a ridge as it is sown) suffered least, whereas there was very little difference in the percentage of injury between maize planted on the surface and that in the open furrow.

Observations on crop rotation systems indicate that those including wheat, oats and lucerne are conducive to infestation if the land is allowed to become grassy before preparing the seed-bed for the next year's crop. Maize planted on land on which it had been grown for a period of years showed less injury than that grown in rotations. Maize planted on stubble land (wheat or oats) ploughed on 15th September had a greater infestation than on that ploughed immediately after harvest.

Pack (H. J.) & Dowdle (V.). **A wild Host of** *Mineola scitulella.*—*J. Econ. Ent.*, xxiii, no. 2, p. 321. Geneva, N.Y., April 1930.

Mineola scitulella, Hulst, which has caused considerable injury to apricot and prune fruits in southern Idaho, was reared there in June and July 1929 from galls caused by an ascomycete, *Plowrightia morbosa*, which were very numerous on the branches and stems of choke-cherry (*Prunus melanocarpa*) in one locality, and were almost invariably infested with Lepidopterous larvae. Several adults of a smaller dark brown species also emerged from the galls. *M. scitulella* was reared from wild plum in another locality early in the summer.

Haseman (L.). **The Hessian Fly Larva and its Method of taking Food.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 316–321, 2 pls., 1 fig. Geneva, N.Y., April 1930.

The anatomy of the digestive tract of the larva of *Mayetiola* (*Phytophaga*) *destructor*, Say, is described in detail. The larva takes only liquid food and appears to be well equipped physically to extract nourishment from plant tissues. A study of the digestive tract fails to explain why it is able to mature more successfully on one strain of wheat than on another.

In the discussion that followed, R. H. Painter stated that cells inside the plant, and 4 or 5 cells away from the larva, have been observed to be injured, and it is probable that secretions from it pass to these cells, which are far beyond the reach of the mouth-parts.

PAINTER (R. H.). **The Biological Strains of Hessian Fly.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 322–326, 2 refs. Geneva, N.Y., April 1930.

Evidence is presented indicating that the differences obtained by various investigators on the resistance of certain varieties of wheat to attack by *Mayetiola (Phytophaga) destructor*, Say, may be accounted for by the presence of distinct biological or physiological strains of the fly.

The following is taken from the author's summary: Under field conditions some of the varieties of wheat in the soft wheat belt of south-eastern Kansas show a different degree of infestation to that occurring when they are attacked in the hard wheat belt of central and western Kansas. Two varieties that were respectively susceptible and resistant in one region proved equally susceptible in the other, and some varieties were found to be resistant in both regions. Under uniform greenhouse conditions flies from the two regions gave infestations approximating to the respective field results. Strains from Ohio and Indiana gave infestations differing from those of the two Kansas strains and from each other. Infestation by flies from the hard wheat belt of wheat varieties planted on a wide range of soils did not vary greatly from the normal for flies from this source. Strains of *M. destructor* with different infestation capacities may be selected from central Kansas flies by the use of individual pairs and by mass selection. In the former case strains have been carried through 3 generations without change in their infestation abilities. It is concluded that these differences in fly population are not due primarily to ecological conditions. The data tend to show that the population of *M. destructor* in any one locality consists of a mixture of two or more genetically distinct strains that differ in their ability to infest various wheat varieties.

PAINTER (R. H.). **Observations on the Biology of the Hessian Fly.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 326–328, 3 refs. Geneva, N.Y., April 1930.

Certain life-history observations made on *Mayetiola (Phytophaga) destructor*, Say, during the isolation of biological strains [see preceding paper] are recorded. Females were allowed to oviposit on wheat plants of one variety possessing only 3 leaves. The positions of the eggs were recorded, and after the formation of the puparia the plants were dissected to determine their position with respect to the different leaf sheaths. It was shown that the percentage of eggs that give rise to puparia was 0 on the first (outer) leaf, 6·45 on the second, and 45·4 on the third (central) leaf. A comparison of the percentage of survival of eggs laid on the third leaf with the total of those on all leaves of all varieties studied shows that there is a mortality of about 25 per cent. in the latter due to the position of the eggs on the plant. The marked decrease in percentage survival from the central leaf outward is comparable with the increase in deposition of cellulose in the cell

walls of the wheat crown where the larvae must begin feeding. It is therefore suggested that the inability to begin feeding on the outer leaves may be due to the presence of cellulose or to some condition arising with it. These facts are of interest in connection with the resistance of certain cereals to infestation.

The progeny from isolated single pairs of the fly was predominantly of one sex. In one case 74 females and no males were reared from one pair. This fact reduces the importance of the migration of single females.

REEVES (G. I.). **Transportation of the Alfalfa Weevil by Railway Cars.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 329–331. Geneva, N.Y., April 1930.

Much of the information contained in this account of studies carried out in Utah in 1928 on the occurrence of *Hypera variabilis*, Hbst., (*Phytonomus posticus*, Gyll.) in lucerne hay and meal has already been noticed [*R.A.E.*, A, xvii, 554], but more detailed investigations are described showing the danger of its distribution by means of railway cars that have carried infested hay.

BIGGER (J. H.). **Notes on the Life History of the Clover Root Curculio,** *Sitona hispidula* **Fab., in Central Illinois.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 334–342, 1 pl., 4 refs. Geneva, N.Y., April 1930.

A study of the life-history of *Sitona hispidula*, F. (clover root curculio), a potentially serious pest of clovers and lucerne, has been carried on since 1924 in central Illinois. The most important records were obtained during the seasons 1925–27. All stages of the weevil are described, and details are given of the technique employed in experimental work. The adults emerge during June and July and live practically an entire year. They are active until continuous hot weather sets in and then inactive until early autumn. Feeding on the leaves of clover and lucerne begins in the first part of September, continues until frosts occur, and is renewed during warm periods in late autumn and winter. Activity is resumed in the latter part of the following March and continues until death. The greatest mortality occurs after 1st May, although many adults die during the winter. Mating begins about the middle of September and recurs during all active periods. The adults survived submergence in water for 24 hours and recovered after being frozen in ice. They seldom fly, but are capable of flights of considerable length and have been collected on wheat at least half a mile from the nearest clover, though they refused to feed on wheat in the laboratory. Oviposition is most general when the temperature is between 50 and 75° F., but has been observed at 40°. It begins about mid-October, occurs occasionally during the winter and continues from March until the death of the adults. The eggs are laid both by night and day ; 80–90 per cent. are deposited in the soil and the remainder on plants. About 150 eggs are laid by a female, of which about 27 per cent. are deposited before the winter. Eggs laid in autumn begin to hatch early in May. Those deposited in spring hatch in 15–21 days. The larvae, which are much more injurious than the adults, may be found in the soil of clover fields 1–6 inches deep from 1st May to the middle of June. They feed for 3 or 4 weeks on the nodules and small roots of clover and lucerne.

The pupal period lasts 17–22 days and chiefly occurs in June, corresponding with the first cutting of lucerne and preceding the cutting of red clover by 2–3 weeks. Hibernation occurs in the adult and egg stages under leaves and rubbish in the fields.

List (G. M.). **Some Experiences in breeding** *Trichogramma minutum* **Riley.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 342–348. Geneva, N.Y., April 1930.

An account is given of experiments in breeding *Trichogramma minutum*, Riley, on eggs of *Sitotroga cerealella*, Ol., in 1928 and 1929 in Colorado. The technique employed was developed largely from that of Flanders [*R.A.E.*, A, xviii, 301, etc.]. Of 10 different grains used in breeding *S. cerealella*, maize and wheat proved to be the best; the larvae prefer wheat to maize as they are able to enter the grain more easily, but the moths from wheat are smaller and not so desirable. The grain was placed in bins 48 ins. long, 26 wide and 3 deep, covered with slats $\frac{1}{8}$ in. apart. These were stacked in piles 8 high on an incline of about 30 degrees with the stacks arranged with an aisle 24 ins. wide. Many of the moths work upward into this aisle where they are collected by means of suction from a vacuum sweeper. These bins proved too long to be handled with ease, and grain was less heavily infested in the centre than toward the ends. Of the two types of oviposition cages employed one is similar to that used by Flanders in which the eggs drop through a screen [xvii, 560]. The other, developed by C. Bjurman, is a standard battery jar, 6 by $8\frac{1}{2}$ ins. The moths are taken directly into it by the suction collector and retained by an inverted manila paper cone that fits closely in the top. The egg-laying device is based on the theory that the moth pushes her eggs into crevices where there is a certain amount of friction on the tip of the abdomen. It is made by wrapping a manila paper cylinder $3\frac{1}{2}$ ins. in diameter and 5 ins. high in a spiral fashion with a $\frac{5}{16}$ in. tape of medium to light celluloid, leaving $\frac{1}{4}$ in. between the spirals. The celluloid tape is slightly curved laterally, and the convex side is against the cylinder, thus leaving each edge slightly raised. The females then push their eggs under the tape from both sides. When the tape, which has been fastened at each end by a paper clip, is removed, practically all the eggs adhere to the cylinder and can be handled on it or brushed off. A few notches should be placed in the lower end of the cylinder to allow the moths to crawl in and out. A second cylinder having a diameter greater by $\frac{3}{4}$ in. is dropped over the first to shade the moths from the light. One cylinder will supply oviposition surface for 5,000–8,000 moths if it is renewed each day. By this method waste of energy on the part of the moths is prevented and increased egg production is secured.

Low humidity was found to prevent the larvae from entering the grain. Whereas with a humidity of 20 per cent. no larvae entered the grain, more than 56 per cent. entered in the incubator with a relative humidity of about 80 per cent. In order to overcome the great loss of newly hatched larvae that occurs in the course of infesting new supplies for spring moth production, small quantities of grain are kept in an incubator at a temperature of 80–85° F., where the humidity can be maintained at about 80 per cent. until the larvae have made an entrance.

An account is given of attempts to control with sulphur two species of mite that hinder the production of *S. cerealella*, the preliminary

results of which have already been noticed [xvii, 184]. Only two sulphurs of a number tried proved effective, but the reason for this has not been determined. The greatest difficulty in handling *T. minutum* is an irregular rate of reproduction. Although the sulphur contributes to this, the condition may prevail in its absence. Eggs of *S. cerealella* are more readily parasitised after being stored in a refrigerator, the best results being obtained from those kept at 38–40° F. for from 4 to 15 days. They have been parasitised to a limited extent after being held for 82 days at 38° F. Parasites reared on eggs that were parasitised after 62 days were about 12 hours longer in developing than those reared on fresh eggs. Eggs should be stored where moisture is high enough to prevent rapid dessication. Storage of eggs offers great possibilities in meeting the demand for large numbers of parasites for a definite time. In view of the possibility that the chorion of the eggs may harden to a point where parasitism becomes impossible, an account is given of a method developed by L. B. Daniels by which the gram weight necessary to puncture an egg with a point of given size is determined. This varies in the case of eggs from different localities and increases as they grow older. The chorion may be slightly softened by placing the eggs on moist blotting paper or by refrigeration in a moist chamber. Cold storage of *Trichogramma* has not proved very effective. The best results have been secured when the eggs are placed in the refrigerator on the fifth or sixth day of an 8-day development period of the parasites, with high humidity and a temperature of 35–40° F.

In the discussion that followed, J. L. Horsfall stated that the difficulty of mite infestation of clothes moth larvae had been overcome by the use of fine dusting sulphur mixed with rabbit fur as a breeding medium. W. E. Hinds stated that the difficulty experienced had been not that the use of sulphur decreased oviposition of *Sitotroga*, but that the parasite declined to attack the eggs where sulphur had been used [*cf.* xviii, 70].

HAWKINS (J. H.). **Wireworm Control in Maine.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 349–352. Geneva, N.Y., April 1930.

The following is taken from the author's abstract: *Agriotes mancus*, Say (wheat wireworm) is a serious pest of field and vegetable crops in Maine [*cf. R.A.E.*, A, xvii, 69]. An upland species of *Melanotus* has recently become second in importance, completely destroying large areas of sweet maize. Certain cultural practices and immune crops have been found to be effective in checking wireworm infestations. Meadows and oat-fields seem to be favourite breeding grounds of *A. mancus*, whereas clover, buckwheat and peas are resistant to its attacks; potatoes are highly susceptible. A fertiliser is useful in strengthening plants to withstand wireworm attacks. Drainage is helpful in controlling *A. mancus*, but autumn ploughing is only partly effective.

CARTER (W.). **Economic Application of Insect-Association Studies.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 353–356. Geneva, N.Y., April 1930.

Studies of insect associations may be of use to supplement standard methods of dealing with the problems of economic entomology. The reactions of each species are considered, not as isolated phenomena,

but in relation to the reactions of other species with which it is associated, every species encountered being at least potentially significant even though its numbers may be so small as to eliminate it from statistical analysis. Such studies carried out over a number of years provide data on the biology of species, food-plant relationships, relations between climate and species, cyclic phenomena, plant disease vectors, and the control of waste lands as reservoirs for economic and potentially economic insects. Association studies, when conducted in connection with economic projects, only involve the additional cost for the routine labour necessary in the sorting and counting of insects, but such studies are well worth undertaking as separate and independent projects, since the results are certain to be of wide economic application.

Campbell (F. L.). **A Comparison of four Methods for estimating the relative Toxicity of Stomach Poison Insecticides.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 357–370, 4 figs., 5 refs. Geneva, N.Y., April 1930.

In order to select the method best adapted for a general survey of relative toxicity, a comparative study was made of several methods of determination. The relative effect of acid lead arsenate and sodium fluosilicate on the fourth instar larvae of the silkworm [*Bombyx mori*, L.] was ascertained by the following methods: the sandwich method [*R.A.E.*, A, xviii, 311] applied to the estimation of the median lethal dose, *i.e.*, the dose that kills 50 per cent. of the insects; the same method used for the determination of the relation between dosage and speed of toxic action; and the simple cage test in which the silkworms were allowed to feed on mulberry leaves sprayed with acid lead arsenate and sodium fluosilicate, both at 2 lb. to 50 U.S. gals. water, and on others dusted with the same compounds, the period in which there was a 50 per cent. mortality being then determined for each group of larvae. The results indicate that the toxicity of sodium fluosilicate to the fourth-instar silkworm ranges from 1 to 2 times that of acid lead arsenate, according to the criterion of toxicity. Sodium fluosilicate incapacitates the silkworm more quickly than does acid lead arsenate, but the latter may kill the larva more rapidly than the former.

Methods by which insects are permitted to consume freely unknown quantities of poison are unsuitable for the determination of the relative toxicity of stomach poisons, because the observed effects are usually produced by unequal mean doses. The cage test, however, with appropriate insects, is probably suitable for measuring relative effectiveness.

Smith (R. H.). **A brief Report on the Tank-mixture Method of using Oil Spray.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 376–382. Geneva, N.Y., April 1930.

The following is taken from the author's abstract: In view of the varying results secured with the large number of proprietary brands of highly refined oil emulsion sprays now on the market, the necessity has arisen for a formula by which a spray of a known composition can be obtained. Investigations indicate that when the type of oil best suited for spraying *Citrus* is used, the principal quality of the spray mixture is that which relates to the quantity of oil deposited and the uniformity of oil coverage. Tests showed that it is entirely practicable with modern orchard sprayers to maintain a uniform mixture of

water, emulsifier and pure oil, added separately to the spray tank [to which the term " tank mixture " is applied], by using large-sized blades on the agitators and increasing the speed of the agitator shaft to about 225 r.p.m. [*R.A.E.*, A, xviii, 210]. By dyeing the spray oil and placing a piece of heavy-walled glass tubing at each end of the spray hose, one between the tank and the hose and the other between the hose and the nozzle, the fact was determined that the oil globules do not coalesce or float out to any material extent in passing through the hose. Microscopic studies of samples taken from the tank and from the nozzle showed that even though globules of relatively large size might pass through the hose, these are broken into very small ones quite comparable to those in proprietary emulsions as a result of being forced through the nozzle under a pressure of 300 lb.

Studies on the quantity of oil deposited on citrus leaves and on glass, 25 sq. ins. being used as the unit of area, showed that certain proprietary emulsions deposited three times as much oil as others. The average amount deposited on the glass was 21 mgm. Tests with the tank mixture, using calcium caseinate spreader at the rate of ½ lb. to 100 U.S. gals. water, showed a deposit of 22 mgm. of oil. All tests were made with 2 per cent. of actual oil in the spray. A reduction of 50 per cent. in the present cost of emulsion is made possible by the use of the tank mixture.

DeLong (D. M.), Reid (W. J.) & Darley (M. M.). **The Plant as a Factor in the Action of Bordeaux Mixture as an Insecticide.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 383–390, 2 graphs, 11 refs. Geneva, N.Y., April 1930.

Previous work regarding the use or action of Bordeaux mixture as a fungicide or insecticide is briefly reviewed. In order to become effective, it appears that it must be rendered soluble. It has been suggested that the most important agents rendering copper soluble from a Bordeaux mixture spray film are atmospheric conditions, especially moisture. On the other hand, it has been stated that the epidermis of the leaf is to a certain extent permeable to the dissolved substances occurring in the cell sap, and that hence the dew without and the cell sap within cause exmosis to take place, rendering the copper hydroxide at least partly soluble. An account is given of experiments carried out to test these statements.

Tests with inverted petri dishes covered with capping membranes [*R.A.E.*, A, xvi, 318] and containing sugar solutions or expressed plant juices showed that copper could be dissolved from Bordeaux mixture residues sprayed on the capping membranes. Distilled water used in the same manner gave negative results. Rain-water, collected over a period of approximately 3 months, that had passed through glass funnels containing filter papers covered with Bordeaux mixture gave negative chemical tests for copper. Soluble copper was, however, very readily detected in rain-water collected from plants that were previously sprayed with Bordeaux mixture, and in distilled or tap water in which sprayed leaves had been washed. Leafhoppers will die in a short time upon plants that have been sprayed with Bordeaux mixture although protected from rain and dew, some factor other than precipitation rendering the copper soluble.

Refractometer readings of the juices of sprayed and unsprayed plants showed that, in the case of plants of vigorous growth, the solid (sugar)

content of the sprayed plants was generally lowered for about two days below that of the unsprayed plants, but soon rose, and with few exceptions remained higher than that of the unsprayed plants for about two weeks.

DeLong (D. M.), Reid (W. J.) & Darley (M. M.). **The Toxicity of Copper to the Potato Leafhopper.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 390–394, 1 graph, 2 refs. Geneva, N.Y., April 1930.

The following is largely taken from the authors' abstract: Copper sulphate solutions of known strength containing 5 per cent. sugars were fed to nymphs of *Empoasca fabae*, Harr. (potato leafhopper) through capping membranes [*R.A.E.*, A, xvi, 70]. Dilutions to and including 1 : 6,500 (·0012 N) gave a rather high degree of toxicity. The nymphs lived for an average of 12 days upon a 5 per cent. sugar solution and an average of 3 days upon distilled or tap water. The supernatant fluid from a 4–6–50 Bordeaux mixture obtained after two hour's settling, combined with 5 per cent. sugar, gave a 14-day average survival. When Bordeaux mixture is properly made, the copper is insoluble in the supernatant fluid. Roots of bean plants were placed in different dilutions of copper sulphate solutions, and leafhoppers were allowed to feed upon these plants. A high rate of mortality was obtained in these tests, and copper was found by chemical tests to be present in the plant juices of the leaves. Spray solutions of copper sulphate and of calcium hydroxide were used on different plants, and nymphs were placed on each of these. The plants treated with copper sulphate showed considerable toxicity, whereas the calcium hydroxide did not affect the leafhoppers.

Jones (M. P.). **The Onion Maggot (*Hylemyia antiqua*) in Ohio, 1929.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 394–398, 1 pl. Geneva, N.Y., April 1930.

Hylemyia antiqua, Mg., which has probably been present in Ohio for a number of years without involving commercial loss, caused injury to onions estimated at £200,000 in one county alone during the summer of 1928. A brief account is given of a spraying campaign against it and of the results secured in 1929, when the flies appeared in large numbers about 27th May. Bordeaux oil emulsions and oil emulsions alone gave about 45 per cent. increase in the yield. There was little difference in yield between plots treated with oil alone or oil in combination with Bordeaux. Boiled lubricating oil emulsion compared favourably with the proprietary oils. It was found that where spraying was done early, weeding was not necessary for 2 months, as the spray killed the young weeds and retarded the growth of older ones. A count of 15,000 onions at harvest showed a reduction of about 66 per cent. in the infestation of sprayed as compared with unsprayed plots. Three types of sprayers, specially devised to suit the conditions of the larger marshes where the onions are grown, are described.

Whitehead (F. E.). **The Pea Weevil Problem.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 398–401, 7 refs. Geneva, N.Y., April 1930.

Although *Bruchus (Mylabris) pisorum*, L., is the most serious pest of peas in the United States, the author is not aware that effective

control has ever been secured. The life-history of *B. pisorum* has never been definitely recorded, and it is suggested that the assumption on which the present control measures are based, that the seed is the important source of infestation, is erroneous. Experiments are described in which infested peas were grown to maturity in insect-proof cages without infestation occurring, thus indicating that infested seed is not the source of an outbreak.

Other possible sources are adults escaping in the spring from stored peas and those escaping from the peas before being stored and overwintering out of doors. In the former case they may be killed by fumigation or their escape may be prevented by storage in suitable bins, but those overwintering out of doors constitute a graver source of danger. As many as 87 per cent. of adults placed in wire cages in protected places out of doors in the autumn survived the winter, indicating that it is possible for a high percentage of the Bruchids that escape from the peas before being stored to overwinter and to constitute an important source of infestation.

SCHWARDT (H. H.). **Borax as an Insecticide for protecting Seed.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 401–404, 7 refs. Geneva, N.Y., April 1930.

In experiments against *Calandra* (*Sitophilus*) *oryzae*, L. (rice weevil) in stored maize, powdered borax was applied to the grain at the rate of 10 oz. to the bushel. Examination after 4–7 months of treated and untreated cans, all of which had been supplied with 25 adults of *C. oryzae* showed that whereas the untreated cans contained large numbers of live and dead weevils and the grain was ruined, the treated ones contained only a small number of dead weevils and the grain was in perfect condition. Germination tests showed that the viability of the grain was unimpaired. *Bruchus quadrimaculatus*, F., was similarly controlled by the application of 20 oz. borax to a bushel of cowpeas. On 1,000 treated cowpeas only 125 eggs were found, whereas a similar number of untreated peas contained 4,868 eggs and only two peas were uninfested. The fact that very few feeding punctures were found on treated maize suggests that borax either acts by contact or is repellent to the extent that weevils starve rather than feed on it. Borax is not poisonous to animals, but is apparently detrimental if fed for a period of time, so that treated grain cannot at present be recommended as food for livestock. Planting maize treated at the rate of 10 oz. to the bushel adds less than 2 oz. of borax per acre to the soil, which is a negligible amount.

FLINT (W. P.). **Effect on Insects of treating Seed Corn with certain Fungicides.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 404–406. Geneva, N.Y., April 1930.

The following is taken from the author's abstract : During the past four years many farmers in the maize belt have been using certain fungicidal treatments for seed maize. Some of the manufacturers of these fungicides have claimed that they would control insects that attack the maize shortly after planting. Tests extending over several years indicate that this is not the case.

PADDOCK (F. B.). **The Bee Moths.**—*J. Econ. Ent.*, xxiii, no 2, pp. 422–428. Geneva, N.Y., April 1930.

Part of the information contained in this review of the history, distribution, bionomics and control of the bee moths, *Galleria mellonella*, L., and *Achroia grisella*, F., has already been noticed [*R.A.E.*, A, xvi, 564]. Apart from certain restricted areas attributed to altitude, and perhaps humidity in the case of *G. mellonella*, the distribution of both moths seems to be world-wide. Although *A. grisella* is not at present known to exist in areas where *G. mellonella* is absent, there is no reason to suppose that any territory will remain free. Comparative accounts are given of the life-history of the two moths, which, apart from the fact that both species persist in connection with beehives, have little in common.

G. mellonella appears to be the first to establish itself in an area, gaining entrance to the hives of weak colonies and thriving in the unused portions of the brood nest. The eggs are laid on the comb, on the underside of the thicker edge of the cell rim. The larva, which is extremely small, enters the comb either by emerging on the rim of the cell and burrowing towards the centre of the comb in the area between the cell walls, or by eating directly through the cell wall and then towards the midrib, like leaf-miners working between the two surfaces of a leaf. A web tunnel is constructed wherever the midrib is eaten so that the larvae are always protected from the bees. The cell walls are not disturbed until the midrib is destroyed. *G. mellonella* does not seem to be able to exist on pure or foundation wax and shows a preference for brood combs. The larvae do not appear to consume pollen, and probably prefer brood cells on account of the refuse they contain, although such food is not essential.

A. grisella usually appears after *G. mellonella* has become established in an area. It seldom attacks combs, but generally acts as a scavenger, existing on refuse accumulated by *Galleria*. The destruction caused by *Achroia* is most noticeable in pure wax. It will infest blocks of pure wax stored for shipment to the foundation mills and will readily attack exposed foundations. As a pest of stored section honey it consumes the caps, causing the honey to leak. It has been stated to feed on dried apples, raisins, crude sugar and even dried insects.

Losses caused by these moths among combs in weak colonies and among stored combs are probably far greater than is generally realised. The destructive power of *G. mellonella* is very great, 6–8 larvae being sufficient to render a comb unfit for colony use. Natural factors of control are lacking and the artificial measures hitherto tried have proved unsatisfactory. Experiments indicate that fumigants lose their effectiveness at temperatures usually prevailing at the time of customary treatment. Paradichlorobenzene was not effective below 75° F., carbon bisulphide is only partly effective at 71° F., and calcium cyanide was not fatal at 70° F. It is difficult to obtain a lethal concentration under practical conditions. Many of the gases are heavier than air, so that in fumigating combs in a stack of bodies or supers, a lethal concentration is not maintained near the top ; there is, moreover, considerable leakage at each joint in the stack involving a relatively high percentage of loss of fumes during the dissipation of the material. In view of these considerations a revision of the method of comb fumigation is suggested. The work should be planned early in the autumn, and an increased dosage used when the temperature falls

below 90° F. The use of lower stacks of combs and covering to render the joints airtight is also suggested.

Among repellents that are of value in protecting combs from moths, paradichlorobenzene is especially effective during the part of the year when low temperatures prevail. Experiments are now under way to determine the effectiveness of the Russian practice of dipping the combs in strong salt solution before storage.

ROARK (R. C.). **Pyrethrum and Soap, a chemically incompatible Mixture.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 460–462. Geneva, N.Y., April 1930.

The nature of the pyrethrins, which are the insecticidal constituents of pyrethrum, is briefly explained, and it is shown that when they are saponified, the resulting products are practically valueless as insecticides. If the use of soap in combination with pyrethrum or pyrethrum extract cannot be avoided, it should be as nearly neutral as possible, no excess of soap should be added, the solution should not be heated, and it should not be allowed to stand before spraying. Failure to observe these rules will result in highly variable effectiveness, owing to the variable decomposition of the pyrethrins. Pyrethrum is incompatible not only with soap, but also with hydrated lime, lime-sulphur solution, sodium-sulphur and barium-sulphur combinations, dry lime-sulphur and other materials that dissolve in or are hydrolysed by water to form alkaline solutions. Pyrethrum or pyrethrum extracts should be sprayed in a solution, emulsion or suspension as nearly neutral as possible and as soon as possible after being mixed with water. The author believes that the addition of saponin, sulphonated oxidation products of petroleum [*R.A.E.*, A, xvii, 714, 715] or other wetting or activating agents to pyrethrum or pyrethrum extract (free from soap) will in most cases produce a mixture of at least as high toxicity as a mixture containing soap, and will have the advantage of being less readily decomposed. In buying pyrethrum flowers or extracts a statement should be required from the manufacturer giving the exact percentage of pyrethrins present. Reference is made to methods for the determination of pyrethrins I and II.

COTTON (R. T.) & ELLINGTON (G. W.). **A simple and effective Ant Trap for Household Use.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 463–464, 1 fig. Geneva, N.Y., April 1930.

Four small sections of cardboard are removed from the inner circular collar of a pill box, the interior of which is waterproofed with paraffin wax, and when in use the top of the box is partly raised, exposing four small openings through which the ants can enter. The box is about two-thirds filled with small pieces of blotting paper to which is added a small quantity of poisoned syrup. A syrup made from thallium sulphate [*R.A.E.*, A, xv, 71], which was used in testing these containers, was found to be exceedingly effective against *Monomorium pharaonis*, L.

ROSEWALL (O. W.) & SMITH (C. E.). **The predaceous Habit of** *Cyrtopeltis varians* **Dist.**—*J. Econ. Ent.*, xxiii, no. 2, p. 464. Geneva, N.Y., April 1930.

During the investigation in Louisiana of stubble left in a tobacco field that had been cut in June, adults and nymphs of *Engytatus*

geniculatus, Reut. (*Cyrtopeltis varians*, Dist.) were observed on 16th August feeding on eggs of *Heliothis*. They were fairly abundant, moving about as though in search of eggs and young larvae among the plants, on which *Heliothis* was scarce. Several nymphs of this Capsid were reared to maturity in the laboratory on eggs of *Heliothis* spp., those of *H. virescens*, F., being more numerous than those of *H. obsoleta*, F. One individual was also reared on first and second instar larvae.

SMITH (R. H.). **Experiments with Codling Moth Bands treated with Lead Arsenate.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 464–465. Geneva, N.Y., April 1930.

The fact that newly-hatched larvae of the codling moth [*Cydia pomonella*, L.] are poisoned by crawling over a surface dusted with lead arsenate [*R.A.E.*, A, xiv, 488] suggests that mature larvae might be killed if bands were treated with lead arsenate dust. Experiments, using burlap bands, however, indicated that the poison had no apparent effect on the larvae, which in some cases were coated with or even embedded in the dust. It is therefore concluded that either the larva swallows nothing after it leaves the fruit, or, if it does swallow occasional particles, the amount ingested is insufficient to prove fatal.

MORSE (A. P.). **Grasshoppers vs. Salt.**—*J. Econ. Ent.*, xxiii, no. 2, p. 465. Geneva, N.Y., April 1930.

Studies of the food preferences of grasshoppers in Nebraska, made with reference to their attacks on binder-twine in grain fields, in which the two species chiefly involved were *Melanoplus bivittatus*, Scud., and *M. differentialis*, Thos., showed that there was much difference in the degree of attack in various fields inhabited by essentially the same grasshopper population. Experiments in which treated samples were exposed both in infested fields and in cages showed that under certain circumstances, salt, which is often used in baits, sometimes did not act as an attractant. No craving for salt was apparently felt by grasshoppers that had been feeding on lucerne or sweet clover, which apparently contained some principle that satisfied this craving, whereas it remained unsatisfied in those that fed on wild grasses and similar vegetation of their habitat. Studies of attacks on binder-twine indicated that whereas grasshoppers devour the twine particularly on the exterior of the sheaves, crickets work chiefly in the interior, making a clean cut.

STAHL (C. F.). **The Lesser Corn Stalk Borer (*Elasmopalpus lignosellus* Zell.) attacking Strawberry Plants.**—*J. Econ. Ent.*, xxiii, no. 2, p. 406. Geneva, N.Y., April 1930.

Injury to strawberry plants observed locally in North Carolina and Florida during the autumn of 1929 was found to be due to the feeding of *Elasmopalpus lignosellus*, Zell. The conditions under which strawberries are grown in the district of North Carolina concerned favours the multiplication of the borer, as the weeds and grasses, many of which are favoured food-plants, are allowed to grow over the strawberry fields until the more important tobacco crop is harvested. When the weeds are finally cut, the strawberry plants remain the only food for the larvae. In the Florida area strawberry plants are often set directly

after the fields are prepared and are thus exposed to attack by any borers that have been feeding in the recently removed grasses. The larvae may also be transferred to the fields with plants from nursery beds that are covered with weeds and where the moths are likely to oviposit. The borer's presence is indicated by dead and dried young leaves in the crown and silk-like tubes to which soil particles cling. No economic loss of importance has been caused, but where the centre of the crown is entirely killed, the side shoots rarely yield as much fruit. Only in rare cases has the plant been killed outright.

Anderson (H. W.), Flint (W. P.), Farrar (M. D.) & Smith (M. A.). **Spray Coverage.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 466–469. Geneva, N.Y., April 1930.

The results of tests failed to substantiate claims put forward for the superior covering qualities of certain brands of miscible oils as compared with those of lime-sulphur and home-made lubricating oil emulsion [*cf.* *R.A.E.*, A, xviii, 71]. One series of tests was carried out in autumn and the other in spring. The very small difference observed in favour of the two miscible oils tested is probably due to the fact that the workmen can more clearly see the twigs hit by them and may cease spraying slightly earlier than in the case of the less visible materials. The actual time occupied in making the application does not vary greatly.

Potts (S. F.). **A Factor concerned in Arsenical Injury to Foliage.**—*J. Econ. Ent.*, xxiii, no. 2, pp. 469–470. Geneva, N.Y., April 1930.

A brief account is given of the problems dealt with in the course of special investigations of foliage injury by arsenicals begun in 1927. In view of the interaction of acids with arsenates, the hydrogen-ion concentration of transpiration water, dew, fog, and rain-water from the leaves of about 50 species of plants was investigated. A neutral to alkaline condition was indicated in the case of 3 species known to be very resistant to an arsenate and Bordeaux mixture, whereas all the other species gave an acid condition of varied pH.

To study the action of arsenates on a number of species of plants, 39 plots were sprayed or dusted. Before and after various quantities of rain, determinations were made of the pH, the quantity of arsenate, the percentage of soluble arsenic, the quantity of arsenic in the tissue, accidental dust, and dew, to 100 sq. ins. of leaf surface. These determinations were used in studying the effect of chemical and meteorological factors on the degree of arsenical injury to various kinds of foliage. The results suggested that calcium arsenate and lead arsenate were much more soluble on the acid leaf surface than in distilled water, and that calcium arsenate was, apparently, much more soluble than lead arsenate. When mixed with lead arsenate, lime apparently formed a considerable amount of calcium carbonate and calcium arsenate [*cf.* *R.A.E.*, A, xiv, 279]. When heavily dosed with lime, some foliage may at first give a slightly alkaline reaction with water, but the first considerable rain removes much of the lime, carrying with it a proportion of the lead arsenate. The surface of the leaf then becomes acid and seems to be able to form lead and calcium salts at the expense of the arsenate, thus setting free the arsenic acid, which would appear to be readily absorbed by the tissues, particularly in the case of young foliage.

It would appear that much of the protection from arsenical injury is due to the removal of arsenates from the foliage through the leaching effect of the lime. Lime was found to be very soluble in water on the leaf at ordinary summer rain temperature ; the first 0·2 inch of rain washed off 85 per cent. of the deposit of poor grade lime, but considerably less if the lime was of a high grade.

Marshall (G. E.). **Some Observations on** *Orius* (*Triphleps*) *insidiosus* **(Say).**—*J. Kansas Ent. Soc.*, iii, no. 2, pp. 29–32, 5 refs. McPherson, Kans., April 1930.

A brief review of the literature on *Orius* (*Triphleps*) *insidiosus*, Say, all stages of which are described, shows that though this Anthocorid is predacious on injurious insects, it has also been observed piercing plant tissues and in one instance feeding on the juices of small garden fruits, and that its eggs have been found in maize silks. In Kansas the author observed oviposition on lucerne ; the eggs were inserted in the main stem at the node, usually in the tender growing distal portion of the stem. It is possible that oviposition may affect the subsequent growth of the plant, since in the field as many as 23 eggs were laid within the space of 1 cm. They hatched in less than 5 days, and in the insectary the life-cycle from egg to adult lasted 22 days. Mating took place 5 days after emergence and oviposition then began. One female laid 65 eggs in 11 days. The adults normally live 15–20 days in summer ; hibernation is passed in the adult stage.

Lawson (P. B.). **Another Season's Trap-lighting of Leafhopper.**—*J. Kansas Ent. Soc.*, iii, no. 2, pp. 35–43. McPherson, Kans., April 1930.

In further experiments in Kansas with light-traps for leafhoppers conducted in 1929, even more individuals were captured than during the previous season [*R.A.E.*, A, xvii, 367]. The information given on the various species is similar to that in the previous paper [*loc. cit.*]. The leafhoppers come to light when there is little wind and temperature and humidity are high.

Beamer (R. H.). **Two** *Erythroneura* **(Grape Leaf Hoppers) damaging Apple in Kansas (Homoptera, Cicadellidae).**—*J. Kansas Ent. Soc.*, iii, no. 2, pp. 49–50. McPherson, Kans., April 1930.

In September 1929, *Erythroneura lawsoniana*, Bak., and *E. omani*, sp. n., were found infesting the foliage of apple in Kansas. Although the damage was not serious, all the leaves were affected and a great many of them had considerably more than half the surface whitened by the loss of chlorophyll. The adults of both species are described.

Jewett (H. H.). **Leafhopper Injury to Clover and Alfalfa.**—*Bull. Kentucky Agric. Expt. Sta.*, no. 293, pp. 157–172, 9 figs. Lexington, Ky., March 1929.

Empoasca fabae, Harr., causes serious damage to clover and lucerne in Kentucky. The first symptoms may appear within 24 hours after the plants are attacked. Infested plants are weakened and are more subject to winter injury. One adult or nymph may cause the death of

young plants. Experiments conducted in 1928 showed that there was a difference in the resistance to attack in various strains of clover and lucerne. As regards clover, imported strains are affected to a greater extent than native ones. Leafhopper injury to clover and lucerne must be regarded as one of the causes, direct or indirect, of the failure of these crops.

Tissot (A. N.) & Thompson (W. L.). **New Aphicides.**—*Florida Ent.*, xiv, no. 1, pp. 7–12. Gainesville, Fla., March 1930.

An account is given of experiments conducted at Gainesville in 1929 with *Macrosiphum* (*Illinoia*) *pisi*, Kalt., and *Aphis spiraecola*, Patch, to determine the value of certain new materials recently placed on the market. The sprays were applied with an atomiser and counts of Aphids were made 24 hours later. A smaller number of field tests gave similar results. New soap spreaders tested included a proprietary pine tar soap, which proved far superior to ordinary soaps as a spreader and carrier of nicotine. Sodium oleate, used at the rate of 1 lb. to 100 U.S. gals. water, with 40 per cent. nicotine sulphate, 1–4,000, gave a good kill of *A. spiraecola*. This soap, which was in granular form, required vigorous agitation in hot water to obtain a solution. Good results were also secured with some of the standard oil emulsions at 1 per cent. strength with 50 per cent. free nicotine at 1–4,000, no foliage injury being apparent on *Citrus* after 48 hours. Penetrol [*R.A.E.*, A, xvii, 715], which readily forms an emulsion with cold water and does not injure foliage, gave promising results at the rate of 0·5 per cent. with only one-fourth as much nicotine as is necessary with ordinary spreaders. Where many curled leaves are present, the use of 0·75 per cent. would be advisable. Some preliminary tests indicated that this oil can also be used with pyrethrum sprays.

It was found that a 2 per cent. nicotine-lime dust made with free nicotine (50 per cent.) was just as effective as a 3 per cent. dust made with nicotine sulphate (40 per cent.). The gas is given off much more rapidly than from nicotine sulphate, resulting in a high concentration soon after application. The price of these materials depends on their nicotine content, so that the fact that only 4 lb. of free nicotine is required as against 7½ lb. nicotine sulphate for 100 lb. dust gives a reduction in cost in spite of the 25 per cent. higher cost of the free nicotine.

Plant Quarantine Information.—*Mon. Bull. Calif. Dept. Agric.*, xix, no. 3–4, pp. 201–281, 48 figs., 5 refs. Sacramento, Cal., March–April 1930.

This is a series of articles on some of the more important insect pests that do not occur or are not generally distributed in California, although found in other parts of the United States. The subject of each article has been approached from the plant quarantine point of view, *viz.*, a non-technical description of the bionomics, distribution, food-plants and economic importance, to give some general idea of how the pest might be transported into uninfested areas.

The articles are: Plant quarantines, their aims and their biological and economic justification, by H. S. Smith (pp. 203–207); the Colorado potato beetle (*Leptinotarsa decemlineata*, Say), by A. G. Ruggles (pp.

208–211) ; the Mexican and thurberia cotton boll weevil [*Anthonomus grandis*, Boh., and *A. grandis thurberiae*, Pierce], by J. W. Folsom (pp. 212–215) ; the Japanese beetle (*Popillia japonica*, Newm.), by C. H. Hadley (pp. 216–219) ; the Asiatic beetle [*Anomala orientalis*, Waterh.], by R. B. Friend (pp. 220–222) ; the vegetable weevil [*Listroderes obliquus*, Gyll.], by H. C. Lewis (pp. 223–226) ; the strawberry root weevils [*Otiorrhynchus* (*Brachyrrhinus*) *ovatus*, L., *O.* (*B.*) *sulcatus*, F., and *O.* (*B.*) *rugosostriatus*, Goeze], by J. Wilcox (pp. 227–230) ; the alfalfa weevil [*Hypera variabilis*, Hbst. (*Phytonomus posticus*, Gyll.)], by G. G. Schweis (pp. 231–234) ; the Mexican bean beetle [*Epilachna corrupta*, Muls.], by G. M. List (pp. 235–238) ; the sweet potato weevil [*Cylas formicarius*, F.], by E. L. Cockerham (pp. 239–244) ; the fruit-flies (TRYPETIDAE) [*Ceratitis capitata*, Wied., *Dacus* (*Bactrocera*) *cucurbitae*, Coq., *D. oleae*, Gmel., *Anastrepha fraterculus*, Wied., and *Rhagoletis pomonella*, Walsh], by H. S. Smith (pp. 245–248), of which the two species of *Dacus* and *A. fraterculus* do not occur in the United States ; the walnut husk fly (*Rhagoletis suavis* subsp. *completa*, Cress.), by A. M. Boyce, with brief notes on *R. juglandis*, Cress., *R. boycei*, Cress., and *R. suavis*, Lw. (pp. 249–253) ; the Mexican fruit-fly [*Anastrepha ludens*, Lw.], by P. A. Hoidale (pp. 254–255) ; the cherry fruit-flies [*Rhagoletis cingulata*, Lw., and *R. fausta*, O.S.], by D. C. Mote (pp. 256–258) ; whiteflies of *Citrus*, by E. W. Berger (pp. 259–261) ; the gipsy, brown-tail and satin moths [*Porthetria dispar*, L., *Nygmia phaeorrhoea*, Don., and *Stilpnotia salicis*, L.], by A. F. Burgess (pp. 262–266) ; the pecan leaf case-bearer and the pecan nut case-bearer [*Acrobasis palliolella*, Rag., and *A. caryae*, Grote], by G. F. Moznette (pp. 267–270) ; the European corn borer (*Pyrausta nubilalis* Hb.), by D. J. Caffrey (pp. 271–274) ; the oriental fruit moth [*Cydia* (*Laspeyresia*) *molesta*, Busck], by L. A. Stearns (pp. 275–278) ; and pink bollworm [*Platyedra* (*Pectinophora*) *gossypiella*, Saund.], by S. D. Smith (pp. 279–281).

REX (E. G.). **The Asiatic Beetles in New Jersey.**—*Circ. New Jersey Dept. Agric.*, no. 178, [15] pp., 10 figs., 2 refs. Trenton, N.J., April 1930.

This brief account of the Asiatic beetles in New Jersey deals with *Popillia japonica*, Newm., *Anomala* (*Phyllopertha*) *orientalis*, Waterh., and *Aserica* (*Autoserica*) *castanea*, Arr. Their distribution in the State in 1929 is shown in maps.

Anomala orientalis almost invariably completes one generation in a year. Apparently 10 months of its existence are spent in the larval stage. The eggs, which are deposited in July and August in the soil of lawns and other short cut grasses, hatch in 10 days, and the larvae begin feeding immediately on the fibrous roots of the grasses. As feeding occurs at an almost uniform level, considerable areas of turf are loosened. The adults, which are first seen about 25th June and persist until the end of August, are extremely inactive, only fly short distances and feed little. Notes on the life-history of *Aserica castanea* [*cf.* *R.A.E.*, A, xviii, 413] indicate that it differs from *Anomala* in that larval feeding occurs at varying levels (1–3 inches below the surface), so that the damaged roots are able to re-establish themselves and little injury is caused. The spraying of ornamental foliage in the area infested by *Aserica* should be guided by the forecast of extremely warm weather. Coated lead arsenate (2 lb. to 25 U.S. gals. water) may provide the

necessary protection, but the use of cheesecloth where possible is probably the most effective measure against damage. The measures recommended for controlling the larvae of all three species in lawns have already been noticed [*R.A.E.*, A, xviii, 272, 413].

CRAIGHEAD (F. C.) & MIDDLETON (W.). **An annotated List of the important North American Forest Insects.**—*Misc. Pub. U.S. Dept. Agric.*, no. 74, 30 pp., 89 refs. Washington, D.C., May 1930.

A list is given of the more important insects attacking forest trees, shade trees and timber in the United States ; in most cases brief notes are added on the distribution of the species, the character of the injury and the most important or available references to it in the literature.

SWEETMAN (H. L.) & FERNALD (H. T.). **Ecological Studies of the Mexican Bean Beetle.**—*Bull. Massachusetts Agric. Expt. Sta.*, no. 261, 32 pp., 1 pl., 11 figs., 23 refs. Amherst, Mass., February 1930.

Epilachna corrupta, Muls. (Mexican bean beetle), which has been a pest of beans in the south-western United States since about the middle of the last century, has spread over most of the eastern regions since 1921. It was found in Connecticut and Massachusetts in 1929 and may become a very serious pest of the bean crop in New England if environmental conditions prove favourable for its reproduction and spread. For this reason the detailed laboratory studies described were undertaken to discover the influence of physical environment on the beetle.

The following is largely taken from the authors' conclusions. A temperature of 37° C. [98·6° F.] kills the adults in a few hours ; 32° C. [89·6° F.] is very unfavourable with high humidity and favourable with low humidity ; 27° C. [80·6° F.] is suitable for heavy oviposition with humidities of 60 per cent. or above and unfavourable with low humidity, but is conducive to length of life with all humidities tested (*viz.* 32–93 per cent.) ; 22° C. [71·6° F.] is favourable with humidities of 40 per cent. or above ; and 17° C. [62·6° F.] with 50 per cent. humidity is favourable for length of life but is very unfavourable for egg production.

In the case of the eggs, a temperature of 37° C. kills the embryos ; 32° is very destructive if it occurs for more than a few hours daily ; 27° is suitable with humidities of 60 per cent. or above and unfavourable with low humidity ; 22° is very favourable with humidities of 60 per cent. or above, but less favourable with low humidity ; and 17° with 50 per cent. humidity is very favourable for hatching but retards development.

With regard to the larvae, a temperature of 37°C. kills them in a few hours ; 32° is very unfavourable, especially with high humidity ; 27° is favourable with high humidity and unfavourable with low humidity ; 22° is very favourable with all humidities ; and 17° with 50 per cent. humidity is very favourable for successful maturation but retards development.

The faunal zones occurring in New England are the Canadian of the Boreal Region, and the Transition and Upper Austral of the Austral Region [*cf. R.A.E.*, A, iv, 522]. It is estimated that the climatic conditions in the Upper Austral Zone of Massachusetts, Connecticut and Rhode Island are favourable for the development of *E. corrupta* and as its principal food-plant (beans) is common, it may be expected to become a serious pest. Conditions in the Transition Zone are less favourable; the beetle may be expected to become a pest over at least the southern part of the area in so far as temperature and moisture are concerned, but may be restricted by lack of suitable food-plants. The injury will probably be greatly reduced as the upper limits of the Zone are reached, and the climate of the Canadian Zone appears to be sufficiently unfavourable to prevent the beetle from becoming a pest. It may, however, migrate into this area from the Transition Zone during the summer and cause a limited amount of local injury.

MacDaniels (L. H.) & Furr (J. R.). **The Effect of Dusting-sulfur upon the Germination of the Pollen and the Set of Fruit of the Apple.**—*Bull. Cornell Univ. Agric. Expt. Sta.*, no. 499, 13 pp., 1 pl., 10 refs. Ithaca, N.Y., February 1930.

An account is given of studies of the effect of sulphur on the germination of apple pollen on agar media, and of experiments in the application of pollen and sulphur dust to apple blossom. They indicate that under certain conditions dust lodging on the stigmas will inhibit pollen germination and will reduce or prevent the setting of fruit. In order to be injurious, however, the sulphur must be on the stigmas before fertilisation has taken place, or at least before the pollen tube has entered the style a sufficient distance to be out of reach of the sulphur. When there is little or no favourable weather for pollination in the early part of the season, an application of sulphur while the trees are in blossom might seriously reduce the yield; if, however, the weather has been favourable during the first part of the blooming period, it is doubtful whether there would be any detrimental effect from dusting with sulphur just before the petals fall or 48 hours after a period of conditions favourable for pollination, provided that the temperature during the interval has not been too cold for the normal growth of the pollen tube. A dust applied during the later stages of bloom might even increase the set of fruit by reducing the competition between flowers on the same spur, which leads to a heavy fall in June. The application of sulphur dust to the blossoms is not advisable in the case of a variety that normally produces a light crop with only one fruit to a spur.

Massee (A. M.). **A new Subspecies of Eriophyid Mite on Plum.**—*Ann. Mag. Nat. Hist.*, (10) vi, no. 31, pp. 145–148, 1 fig. London, July 1930.

Eriophyes similis prunianus, subsp. n., is described from galls on the lower surface of the leaves of plum in Manitoba. A description is also given of the typical *E. similis*, Nal., which causes galls on the same plant in England, Italy, Sicily, the Crimea, Poland and Finland.

Steenburgh (W. E.). **A Season's Work on the Colonization in Ontario of** *Macrocentrus ancylivora* **Rohwer, a Parasite of the Oriental Peach Moth** (*Laspeyresia molesta* **Busck**).—*Canad. Ent.*, lxii, no. 4, pp. 71–75, 1 fig., 1 ref. Orillia, Ont., April 1930.

A detailed account is given of the introduction of *Macrocentrus ancylivora*, Rohw., into Ontario, from southern New Jersey for the control of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental peach moth). Although 15 native species of parasitic Hymenoptera [*cf.* *R.A.E.*, A, xviii, 122] have been found to attack the moth, the total percentage of parasitism is very low. Since the life-cycle of *M. ancylivora* coincides with that of *C. molesta*, the parasites were released in infested orchards at a favourable time for increase during the three summer generations of the host. To ensure the best possible conditions for their survival, two colonisation centres about 7 miles apart were chosen near large strawberry beds where *Ancylis comptana*, Fröl. (strawberry leaf-roller), which is an alternative host, was available. The results were very encouraging. Collections of twigs infested by third generation larvae of *C. molesta* showed that the parasite had spread over an area of about 35 sq. miles, an appreciable amount of control being demonstrated. Hibernation will probably occur in either of the available hosts.

DeLong (D. M.). **A new Species of Bean Leafhopper from Haiti.**—*Canad. Ent.*, lxii, no. 4, pp. 92–93, 1 fig. Orillia, Ont., April 1930.

Empoasca fabalis, sp. n., is described from Haiti, where it was found in large numbers on beans and sweet potatoes. It has previously been recorded as *E. fabae*, Harr., and apparently replaces the latter as a pest of vegetables in Haiti. *E. fabae* probably does not occur in the tropics.

Hope y Hope (P.) & de la Lama (M.). **El arsénico y sus derivados, como insecticidas.** [Arsenic and its Derivatives as Insecticides.]—*Estud. Ofic. fed. Defensa agríc. Sec. Agric. Fom. México*, no. 3, 63 pp., 3 figs., 36 refs. S. Jacinto, D.F., 1929.

An account is given of the arsenical salts used as insecticides and of the composition of various arsenical products in common use in Mexico, the methods of analysis being described.

da Costa Lima (A.). **Sobre insectos que vivem em maracujás** (*Passiflora* **spp.**). [Insects infesting *Passiflora* spp.]—*Mem. Inst. Oswaldo Cruz*, xxiii, no. 3, pp. 159–162, 3 pls. Rio de Janeiro, March 1930.

Two insects attacking *Passiflora edulis* in the State of Rio de Janeiro are a Coreid, *Holymenia clavigera*, Hbst., and a fruit-fly, almost certainly *Anastrepha consobrina*, Lw. The former is parasitised by an Encyrtid, *Hexacladia smithi*, Ashm., which also attacks the Pentatomid, *Pachycoris torridus*, Scop. Adults of *A. consobrina*, fed on honey, lived for a little over 30 days.

Magarinos Torres (A. F.). **O** *Aphelinus mali*, **Hald.**—*Chacaras e Quintaes*, xli, no. 4, pp. 343–345. S. Paulo, 15th April 1930.

A list is given of the countries into which *Aphelinus mali*, Hald., has been imported since 1920, the results achieved with it against *Eriosoma lanigerum*, Hausm., being stated in each case if known. It was introduced into Brazil in 1923, and is stated to have controlled the Aphid in the State of Rio Grande do Sul.

Eltringham (H.). **Histological and illustrative Methods for Entomologists.**—Cr. 8vo, xii+139 pp., 1 pl., 18 figs. Oxford, The Clarendon Press ; London, Humphrey Milford, 1930. Price, 7*s*. 6*d*. net.

This useful book is primarily intended as a guide for those who have not received laboratory training. In the first part, the more elementary methods used in the study of the anatomy and histology of insects are described, chapters being devoted to the apparatus and materials needed, genitalia preparations, section-cutting and staining. The remainder of the book comprises chapters dealing with the making of drawings and models and the colouring of lantern slides and photographs, and one (contributed by H. Britten) on making preparations of small entire insects.

The author states that he has himself repeatedly used the majority of the processes described, with successful results.

Bodenheimer (F. S.). **Die Schädlingsfauna Palästinas. Unter besonderer Berücksichtigung der Grosschädlinge des Mittelmeergebietes.** [The Insect Pest Fauna of Palestine. With particular Regard to the Chief Pests of the Mediterranean Region.]—*Monogr. angew. Ent.*, no. 10 (*Beih. Z. angew. Ent.*, xvi), xv+438 pp., 206 figs., 1 map, 3 pp. refs. Berlin, P. Parey, 1930. Price *M*.42.

This monograph, which is the first attempt to present a connected picture of the insect pests of the Eastern Mediterranean, is based almost entirely on experience gained by the author during eight years' work against the insects attacking cultivated plants in Palestine. Of the very large number of pests dealt with, each of the more important ones is treated individually, a brief description being followed by notes on bionomics and control. Chapters are also devoted to beneficial insects, forest pests, pests of stored products, insecticides, crops cultivated, and a general review of the conditions of the country.

Actes du Conseil international scientifique agricole. Première Session (7-12 Novembre 1927).—Roy. 8vo, vol. i, 702 pp., vol. ii, 754 pp. Rome, Inst. internat. Agric., 1928. [Recd. 1930.]

In the first volume accounts are given of the sessions of the various Commissions of the International Scientific Council of Agriculture, together with summaries of the reports of the members from different countries on the subjects under discussion. The second volume contains papers by individual members, which in some cases collate the information given in the first, and in others deal with different aspects of the same subjects.

One of the subjects discussed by the Commission for Plant Pests and Diseases was the official control of fungicides and insecticides (vol. i, pp. 362–363), this is reviewed more fully by P. Marchal in the second volume (pp. 521–527). Special sections dealt with the olive fly (*Dacus oleae*, Gmel.) ; cotton pests ; and locusts. The resolutions adopted have also been published elsewhere [*R.A.E.*, A, xvi, 650].

The information on *Dacus oleae*, Gmel. (vol. i, pp. 367–381) is summarised by F. S. Bodenheimer (vol. ii, pp. 536–541). The situation with regard to the chemical control of the fly in various countries and its distribution are briefly reviewed. Little is known about the resistance of the varieties of olive to its attack, and further information is required. The biological control of the fly in France, Palestine, Spain, Algeria, Tunisia and Morocco is briefly discussed.

The reports on cotton pests in vol. i (pp. 383–386) include records of *Earias insulana*, Boisd., and *E. vernana*, Hb., from the Mediterranean coast of Spain, where they cause severe damage to the flowers and developing bolls. In Italian Somaliland *Platyedra gossypiella*, Saund., *Heliothis* (*Chloridea*) *obsoleta*, F., and *Diparopsis castanea*, Hamps. (red bollworm) are important pests, as are the Jassid, *Empoasca* (*Chlorita*) *facialis*, Jac., and *Syagrus rugiceps*, Lef., the larvae of which feed on the roots and the adults on the leaves. Less serious injury is caused by *Earias biplaga*, Wlk., *Dysdercus cardinalis*, Gerst., and *Oxycarenus hyalinipennis*, Costa. The report in vol. ii (pp. 542–552) by H. Morstatt contains a review of the biology, distribution and control of *Anthonomus grandis*, Boh. (Mexican boll-weevil) and *Platyedra* (*Pectinophora*) *gossypiella*, Saund. (pink bollworm).

The discussions on locusts are dealt with very briefly in the first volume (pp. 387–390) ; in the second a report is given by C. Isaakidès (pp. 553–559) on the organisation of locust control in Greece, where the species occurring are *Calliptamus* (*Caloptenus*) *italicus*, L., and *Dociostaurus maroccanus*, Thnbg.

Staniland (L. N.), Tutin (F.) & Walton (C. L.). **Investigations on Egg-killing Washes at the Long Ashton Research Station.**—*J. Pomol. Hortic. Sci.*, viii, no. 2, pp. 129–152, 6 pls., 3 diagrs., 13 refs. London, May 1930.

The results of the work at Long Ashton on tar-distillate spray fluids as egg-killing washes, from its beginning in 1921 up to the end of the field trials conducted in 1928–29, are briefly summarised [*R.A.E.*, A, xviii, 176, etc.].

In an endeavour to elucidate the manner in which insect eggs are prevented from hatching by winter washes, experiments were conducted in the laboratory against the eggs of *Cheimatobia brumata*, L. (small winter moth). Almost all the products were applied 6 weeks before the eggs hatched. Among the substances tested were suspensions of the pure crystalline solids contained in the neutral tar-distillate, since it was hoped in this way to throw some light on the location of its toxic properties. It is concluded from the results that the killing of the winter moth eggs is due chiefly to a " stifling " action caused by the deposition of a uniform, oily film over them, since heavy medicinal paraffin was as effective as the " high neutral " tar oil. The fact that the low boiling neutral constituents of the coal-tar and an Asiatic petroleum product were of much greater efficiency when applied to the eggs a few days before the latter would normally hatch than when

applied six weeks before that time, was evidently due to their relatively high volatility. The pure individual components of the neutral tar oil appear, however, to possess true toxic properties to winter moth eggs, particularly in the case of diphenyl oxide ; but this substance is present in such small quantities in the neutral tar oil, that the efficacy of the oil evidently consists chiefly in its " stifling " action, at least so far as winter moth eggs are concerned.

Neither heavy lubricating oils nor heavy medicinal paraffin prevented hatching of the eggs of the permanent apple aphis [*Aphis pomi*, DeG.], and the effectiveness of tar distillates in this respect appears to be due to their toxic action. Subsequent examination of plantations treated with a winter wash made from petroleum products showed that good control of Capsids and Lepidoptera had been effected, but considerable infestation with Aphids and *Psylla mali*, Schmidb., was evident.

It is therefore essential for the efficiency of a winter wash that it should be prepared from a liquid capable of covering insect eggs on trees with a uniform, varnish-like film that will not be removed by rain and will not evaporate appreciably before the time at which they hatch. The production of such a film depends to some extent on the method employed for the emulsification of the ovicidal material used.

The reason for the comparative inefficiency, especially with respect to the control of *Plesiocoris rugicollis*, Fall., of the older tar washes made from a total distillate, is that they contain a considerable proportion of relatively volatile material, which evaporates before the time at which the eggs are most readily killed (probably the last few days before hatching). Moreover, they contain tar " acids " and " bases," which not only have a lower ovicidal power than the neutral constituents but are also easily washed out by rain from the material deposited on the eggs, and take with them an appreciable quantity of the valuable neutral products, leaving the eggs with an imperfect coating of oil.

It is suggested that the results obtained against *P. rugicollis* on black currant were less satisfactory than those obtained against the same pest on apple [xvii, 674], because the egg protrudes further when deposited on black currants and it is therefore much more difficult to ensure that the upper extremity is provided with the necessary permanent, oily film.

Massee (A. M.). **The Control of the Fruit Tree Red Spider** (*Oligonychus ulmi* **C. L. Koch) of Plum during the growing Season.**—*J. Pomol. Hortic. Sci.*, viii, no. 2, pp. 184–194, 1 pl., 4 refs. London, May 1930.

Paratetranychus pilosus, C. & F. (*Oligonychus ulmi*, auct.) is one of the most serious pests that occurs on plums in Britain at the present time, the recent increase in its numbers being due in all probability to the tar-distillate washes applied to the trees annually during the dormant season [*R.A.E.*, A, xvii, 500]. The lime-sulphur spray recommended against this pest on apple [xvii, 501] cannot be applied to plums, because at the time the mites hatch the apples are in the " pink bud " stage, but many of the commercial varieties of plums are in full flower. An experiment was therefore undertaken to determine whether lime-sulphur and other sprays could be used on plums after the blossom period without causing injury. By 17th May the majority of the

winter eggs had hatched and the first sprays were applied on the 22nd, about 14 days after the fall of the plum blossoms ; the second applications were made on 6th June and the third on 22nd June. The mite was controlled on all trees sprayed with lime-sulphur (1 : 99) and the foliage retained its natural colour until leaf fall, whereas the leaves of the other trees turned brown and many trees were prematurely defoliated. Most of the eggs in the autumn were found on the unsprayed trees or on those sprayed with Bordeaux mixture (8 : 12 : 100) or 1 per cent. white oil emulsion, neither of which is toxic to the mites at the strengths used. It is thought that if all the trees had been treated with lime-sulphur very few eggs would have been present in the autumn, but the control trees were scattered throughout the plots and there is little doubt that many mites migrated from them to the sprayed trees. It was also observed that the trees sprayed with Bordeaux mixture were more heavily infested than the untreated ones, and it is suggested that the spray affected the predacious enemies of the mite. The lime-sulphur spray does not reduce the crop nor injure the foliage or fruit. Its success depends largely on the time of application, which should be after most of the winter eggs have hatched and before the resulting mites have commenced to deposit their summer eggs on the leaves. This period varies each season, but is usually sufficiently long to enable spraying to be completed. In practice the spray should be applied about two weeks after the blossom period, when the fruitlets are developing.

WALTON (C. L.). **The Raspberry and Loganberry Beetle and its Control : some Experiments with a Pyrethrum Emulsion Spray.**—*J. Pomol. Hortic. Sci.*, viii, no. 2, pp. 173–183, 14 refs. London, May 1930.

Byturus tomentosus, F., is the most serious pest of raspberries and loganberries in Britain [*cf. R.A.E.*, A, vi, 424, etc.]. Commercial control has been obtained by spraying with lead arsenate [xi, 539], but owing to the danger of poisoning bees, an investigation was undertaken with a view to testing pyrethrum emulsions against this beetle. Laboratory experiments were promising [xvii, 536], and field trials were carried out in 1928 and 1929. The spray used [*cf. loc. cit.*] was prepared by dissolving the crude pyrethrins from 100 lb. of flowers in 15 gals. rape oil and adding 5 gals. of Agral W.B. When required for use, 2 gals. of this mixture were combined with 98 gals. water and 2 pints of 40 per cent. aqueous caustic soda were then added and stirred in. The oil solution of the crude pyrethrins should not be mixed with the Agral W.B. earlier than is necessary, since this mixture slowly loses its insecticidal value. Emulsification by means of the alkali should not be carried out until immediately before use. Where loganberries and raspberries were grown in close proximity, the preference of the beetles for flowers of the former was again observed [vi, 424]. In 1928, the spray was applied to loganberries on 6th June, when approximately one-third of the flowers was set, one-third open and one-third still in bud. Appreciable differences in the percentage infestation of sprayed and unsprayed plots were observed. A row of raspberries was sprayed on 18th May when the first flowers opened, to determine whether the spray exercised any deterrent effect on the beetles, but subsequent counts showed no significant differences in infestation between sprayed and unsprayed plots.

In 1929, sprays applied to loganberries on 1st, 7th and 21st June and to raspberries on 5th, 19th and 25th June (when approximately one-third, two-thirds and all of the flowers were fully open) resulted in a reduction of infestation of approximately 55 per cent. on the former and 50 per cent. on the latter. The beetles can thus be commercially controlled.

SMITH (K. M.). **Studies on Potato Virus Diseases. VII. Some Experiments with the Virus of a Potato Crinkle with Notes on Interveinal Mosaic.**—*Ann. Appl. Biol.*, xvii, no. 2, pp. 223–240, 4 pls., 3 refs. Cambridge, May 1930.

An account is given of experiments in Britain in the transmission of two potato virus diseases, potato crinkle and interveinal mosaic, by means of needle inoculation, grafting or the Aphid, *Myzus persicae*, Sulz., from potato to potato, from potato to tobacco, etc. Transmission of crinkle from diseased to healthy potatoes by means of *M. persicae* was successful in the case of one variety only, when a mild type of the disease developed. When the virus was transmitted by the same Aphid to tobacco, the symptoms produced were different from those induced by needle inoculation. When it was returned to potato by the Aphid or by needle, crinkle and leaf-drop streak resulted. Moreover, after passage through tobacco, the same virus was transmitted by the Aphid to a variety of potato that had previously resisted inoculation by this means. Thus it is shown that the tobacco plant will act as a more or less symptomless carrier of severe crinkle and leaf-drop streak when infected by Aphids from diseased potato, and this may explain the rapid degeneration of some varieties of potato in countries where tobacco is grown. For this reason, it seems advisable for the two crops to be grown as far apart as possible. The virus of interveinal mosaic was transmitted by *M. persicae* from a potato plant of one variety to others of the same variety, but not to those of another variety.

In these experiments further evidence was obtained of the alteration of the nature of potato viruses of the mosaic group by passage through plants other than potato [*cf. R.A.E.*, A, xvii, 636]. It was also found that the symptom expression of a particular virus in its plant host may vary according to the method of infection, and in the case of potatoes there is a wide range of difference in their varietal reaction to the same virus. The relation between the virus of crinkle and that of interveinal mosaic and their possible connection with the virus of streak are discussed.

THOMPSON (W. R.). **The Principles of Biological Control.**—*Ann. Appl. Biol.*, xvii, no. 2, pp. 306–338. Cambridge, May 1930.

In view of the rapid development of practical experiments in biological control, the author discusses its nature, its application to insect pests and noxious weeds, the situations in which it can be utilised, the results that may be expected from it, and the character and practical value of biotic controlling factors of various types. The main factors in the biological control of insect pests are pathogenic organisms, which are sometimes very effective but practically impossible to manipulate successfully ; vertebrate predators, which appear to be of minor value

and could probably not be utilised in practice; and invertebrate parasites and predators, of which the entomophagous insects are by far the most important and the most useful.

The various methods by which biological control of insect pests is attempted are discussed and illustrated by theoretical calculations. It is estimated that, on the whole, the intensification of the action of natural enemies present in an area by the artificial reduction in the numbers of the host (by the destruction of unparasitised insects and the preservation of the parasitised individuals until the parasites have emerged) is of rather uncertain value, and not likely, in most cases, to produce results proportionate to the time and labour expended. A gradual rise in the percentage of parasitism may result, but unless they are prevented from doing so by a decrease in the numbers of their host, the parasites and predators will continue to deposit the same number of eggs and kill the same number of hosts as under normal conditions.

With regard to control by artificially increasing the population of parasites or predators normally present in an area, it is pointed out that although the percentage of parasitism may be quite small, the actual numbers of parasites present in a relatively limited area severely infested by the host may be very large, and in order to produce a measurable effect in an area of any considerable size it would be necessary to liberate a very large number of parasites. The same considerations apply to an attempt to accelerate the progress of an introduced parasite by liberating additional colonies year after year following the establishment of the species. When the reproductive rates of host and parasite are equal, the time required for the increase of the latter species to the point at which it exerts its maximum effect depends directly, other things being equal, on the numbers of parasites liberated, but the acceleration brought about by the successive liberations of additional parasites, although definite, becomes increasingly less significant. In the case of a parasite with a reproductive rate higher than that of its host, the effect of repeated introductions on its rate of increase is practically negligible. Repeated introductions are only likely to be of any value when a pest is present in several distinct colonies, separated by areas over which the introduced parasites cannot pass.

Anything in the nature of encouragement of beneficial species already present in an area seems thus to be restricted to indigenous species. Although a marked increase in the number of progeny reaching maturity in the field could probably be obtained in many cases by careful methods of rearing in the laboratory, it would be of little use to liberate additional individuals of a parasite before a period or season in which adverse climatic or agricultural factors ordinarily cause the death of a large proportion of the population. Thus almost the only beneficial insects that can be "encouraged" are species that can be bred easily and continually during periods when they are dormant in nature and their hosts are either dormant or not present in a stage attacked by the parasite or predator. Moreover, it is necessary in carrying on breeding work to have a plentiful supply of a host species that is easily bred on food that is inexpensive and easy to procure.

With regard to the introduction of natural enemies into an area where they have not previously been found, it appears advisable to establish all the primary parasites of an introduced pest that can be

obtained, although it seems most satisfactory to make the introductions successively rather than simultaneously, importing new species only after the effect of those already established has been determined [*cf. R.A.E.*, A, xvii, 653].

Concerning the re-introduction of a beneficial insect temporarily absent from an area, it is pointed out that, firstly, it is extremely difficult to determine whether the species is really absent, and secondly, if it is absent, its disappearance is usually due to temporarily unsuitable conditions that would probably adversely affect any attempt to re-introduce the species. Such re-introduction is therefore only justified when some unusual factor, such as an abnormal drought or an exceptionally hard winter, has practically or absolutely exterminated a beneficial insect from a region where repopulation from adjacent areas is impossible or can only occur very slowly owing to the existence of barriers. In the author's opinion the introduction of insects that in other countries attack hosts closely allied to the pest to be controlled offers a promising field for investigation.

The results that may be expected from experiments in biological control depend primarily on whether the host is increasing in numbers or not. If it is increasing, the parasite will never overtake the host unless its reproductive rate is greater than or equal to that of the latter. If the reproductive rate of the parasite is only slightly superior, the time taken to overtake the host will be greatly decreased when compared with the time taken when the rates are equal. Moreover, if the host is increasing, no reduction in damage or decrease in its numbers will occur until the parasite has overtaken it. If the host population has become stabilised, the increase of the parasite has an immediately beneficial effect. The reduction of damage will continue until the rarefaction of the host population begins to cause a diminution in the effective reproductive rate of the parasite, after which the host population will again increase for a time.

Generally speaking, no one species of parasite or predator is likely to control the host over the whole of an infested area, and the introduction of additional species will usually be necessary. Moreover, in many cases, agricultural, chemical and mechanical methods must also be employed.

Barnes (H. F.). **On the Biology of the Gall-midges (Cecidomyidae) attacking Meadow Foxtail Grass** (*Alopecurus pratensis*), **including the Description of one new Species.** —*Ann. Appl. Biol.*, xvii, no. 2, pp. 339–366, 10 refs. Cambridge, May 1930.

Meadow foxtail grass (*Alopecurus pratensis*), which was formerly used to a considerable extent in seed mixtures for pasture and meadow land, has recently been replaced to a large extent by timothy (*Phleum pratense*), one of the reasons for the change being the failure to obtain good seed of the former owing to infestation by three Cecidomyiids, *Dasyneura alopecuri*, Reut., *Stenodiplosis geniculati*, Reut., and *Contarinia merceri*, sp. n., all of which are widely distributed in the British Isles and probably occur in almost every country where the grass is grown. Notes on their distribution and bionomics are given. *D. alopecuri* has one generation a year. The eggs are laid in May, the larvae grow from May to July and remain quiescent in the seeds from July until May of the following year. *S. geniculati* has two generations

a year, adults being on the wing in April and May and again from June to August. The life cycle of the summer brood lasts about 3–4 months and of the winter brood 8 months. In both these species pupation takes place in the seed case, the pupal stage lasting about 8 days, and the larvae usually occur singly in the florets. As a rule, *C. merceri* has one generation a year. The adults occur in May–June, and the larvae grow in the florets for 3–5 weeks about June, and then migrate to the soil, where they remain until the following May. This species differs from the other two in that the larvae do not, as a rule, occur singly in the florets, and hibernation and pupation take place in the soil. It also appears to be much more numerous and to be responsible for the enormous number of empty florets and immature kernels found by seed-testers.

It is suggested that the numbers of the midges might be reduced by allowing sheep to graze on the grass and so prevent its flowering until after most of the adults have emerged. The date of emergence varies with the locality and would have to be determined by careful observations over a number of seasons. Grass heads that ripen later are smaller and therefore contain fewer seeds than those ripening normally, but this disadvantage might be overcome by selection and plant breeding. In an experiment in which plots of grass were kept cut until certain dates and then allowed to seed, the extra cleanness of the seed more than compensated for the reduction in the size of the head.

RICHARDS (O. W.) & HERFORD (G. V. B.). **Insects found associated with Cacao, Spices and Dried Fruits in London Warehouses.**—*Ann. Appl. Biol.*, xvii, no. 2, pp. 367–395, 10 pls., 6 pp. refs. Cambridge, May 1930.

A list is given of the insects found in association with cacao, spices, and dried fruit in certain London warehouses, indicating their distribution and in some cases the places of origin of the products in which they occurred, with references to some of the more important papers in which the food, habits or distribution of the species have been described. Keys are given to the species of the following genera that were encountered: *Carpophilus*, *Laemophloeus*, *Dermestes*, *Gnathocerus* and *Tribolium*, *Ephestia* and *Drosophila*. The list includes 78 species and one variety of Coleoptera, 10 species of Lepidoptera, 6 of Hymenopterous parasites, 21 of Diptera, 2 of Rhynchota, 5 of Orthoptera, 1 of Dermaptera, and 4 of Psocoptera.

COLLINGE (W. E.). **The Food and feeding Habits of some Corvidae. The Carrion Crow, Hooded Crow, Magpie and Jay.**—*J. Minist. Agric.*, xxxvii, no. 2, pp. 151–158, 4 diagrs., 2 refs. London, May 1930.

The economic status and food habits of the carrion crow, hooded crow, magpie and jay are discussed. A study of the stomach contents of each of these birds showed that on the average 36 per cent. of their food is of direct benefit to the farmer and fruit-grower, 21·6 per cent. being injurious insects, whereas only 18 per cent. represents damage inflicted. So long as these birds are not too numerous, the benefits they confer far outweigh the injury they do, and any attempt at their complete destruction is prejudicial to the interests of agriculture.

Whitehead (T.) & Currie (J. F.). **Potato Leaf-roll. Development of secondary Symptoms in the Year of Infection.**—*J. Minist. Agric.*, xxxvii, no. 2, pp. 159–163, 6 figs., 5 refs. London, May 1930.

An account is given of greenhouse experiments to determine whether there is a stage in the growth of the potato plant prior to which leaf-roll infection might give rise to secondary symptoms during the current year, but after which infection would first become evident in the progeny of the plant [*cf.* *R.A.E.*, A, xviii, 2]. This is of considerable practical importance, as the primary infection produces no marked reduction in the yield, whereas plants developing secondary symptoms are severely affected both in the number and (in many varieties) the size of the tubers. By transferring Aphids from plants infected with leaf-roll to healthy ones in different stages of growth, it was found that secondary symptoms may develop in the year of infection in plants infected before they have reached a certain critical stage in growth. This stage varies with the variety of potato (up to 5 and 8 weeks after planting in the two varieties employed). About a month elapses between infection and the appearance of symptoms, this being probably the necessary incubation period for the virus in the leaf. The Aphids were shown to be able to acquire infection from infected plants before any symptoms develop.

It therefore appears that the presence of secondary symptoms will afford a reliable index of the degree of infection of the seed-stock only if it is known that the plants obtained from it had passed the critical stage in growth before Aphid infestation occurred.

Massee (A. M.) & Beshir (M.). **The Control of the Apple Blossom Weevil.**—*J. Minist. Agric.*, xxxvii, no. 2, pp. 164–171, 1 ref. London, May 1930.

An account is given of banding experiments carried out in 1929 against *Anthonomus pomorum*, L. (apple blossom weevil). The bands were placed on the trees in mid-July and examined at the end of November. The weevils showed a marked preference for bands of corrugated cardboard over those of carpet felt and sacking [*R.A.E.*, A, xiii, 61], the average number caught per band of each type being 390, 206 and 40 respectively. The corrugated cardboard, which was covered on the smooth surface by grease-proof paper, was cut in strips 4½ ins. wide, and the carpet felt was ¼ in. thick and cut into strips 6 ins. wide. These bands were applied in single thickness only, whereas the strips of sacking, which were 4½ ins. wide, were twice as long as the circumference of the tree trunk to make a double thickness when in position. The inside layers of the corrugated cardboard separate in wet weather, and, unlike the sacking, do not become sodden, thus providing an excellent shelter. The cost of these bands is about 10*s.* for 200 trees, including labour ; that of the sack bands is approximately 20*s.* when new material is bought, though if old sacking is available, the price is about the same as for the cardboard bands. The high cost of carpet felt and the difficulty of obtaining it in quantity preclude its use on a large scale.

An experiment showed that weevils hibernating in sacking bands could be destroyed by spraying the latter on the trees with a 10 per cent. tar-distillate wash, 2½ gals. being sufficient for 18 bands, which should be thoroughly soaked. It was found that many of the weevils

hibernated on the bark immediately beneath the bands, but on examination about three weeks after spraying, most of them, as well was those in the bands, had either been killed by the wash or were paralysed and died later. Less than 25 per cent. of the weevils were active when taken from the bands, and many of these did not live more than a few days. Nearly twice as many weevils were collected from untreated bands and trunks, and it is thought that some were driven from the treated bands at the time of spraying ; a large proportion of them must, however, have been affected by the wash and probably died. In practice the bands can be sprayed while the usual winter tar-distillate wash is being applied ; this should be done not later than January, since the weevils begin to leave the bands in February.

This method is superior to that of burning the bands or submerging them in water [*loc. cit.*], as when they are removed many weevils fall to the ground and escape, and those that hibernate on the bark beneath the bands are not destroyed.

Laubert (R.). **Eine eigenartige Hyazinthenblumenknospen-Schädigung.** [A peculiar Injury to the Flower-buds of Hyacinths.]—*Die kranke Pflanze*, vii, no. 3–4, pp. 48–49. Dresden, 1930.

Discolouration and withering of the flower-buds of hyacinth in Germany were found to be due to the mite, *Rhizoglyphus hyacinthi*, Banks, feeding within them, especially on the stamens. No other parts of the plant were injured.

Reichert (A.). **Rosenschädlinge.** [Rose Pests.]—*Die kranke Pflanze*, vii, no. 3–4, pp. 49–53, 1 pl., 4 refs. Dresden, 1930.

The eggs of *Arge rosae*, L., and *A. pagana*, Panz., are laid on the young rose shoots, and the newly-hatched larvae remain together, feeding on the leaves. Pupation takes place in the ground, but in captivity some larvae pupated on the branches. The adults prey on various insects.

Reh (L.). **Obstbeschädigungen durch Wanzen.** [Injury to Fruits by Bugs.]—*KorrBl. wirtsch. SchädlBekämpf.*, vi, no. 2, reprint 1 p. Crossen a. d. Oder, 1929.

Considerable damage is done to bush-fruits in Germany by Pentatomid bugs, of which *Dolycoris baccarum*, L., is the most important, others being *Pentatoma* (*Tropicoris*) *rufipes*, L., *Acanthosoma haemorrhoidale*, L., *Sehirus bicolor*, L., etc. Capsids of the genus *Lygus* are very injurious to apple, the leaves, shoots and fruits being affected, but a great variety of other plants are infested in summer.

Krüger (—). **Spanner-Bestäubung im Stadtforst Waren-Mecklenburg.** [Dusting against *Bupalus piniarius*, L., in the Waren Civic Forest, Mecklenburg.]—*Deuts. Forst-Ztg.*, xliv, pp. 1005–1008, 3 figs., 1929. (Abstract in *Zbl. Bakt.*, (2) lxxxi, no. 1–7, p. 158. Jena, May 1930.)

It is pointed out that trees are more completely covered by an insecticide dust if it is applied by motor dusters instead of by aeroplane, because the application is a double one, the dust being first blown upwards through the tree crown and then falling downwards on it.

Voigt (G.). *Chortophila brunnescens* **Zett. als Schädling kultivierter Caryophyllaceen.** [*Hylemyia brunnescens* as a Pest of cultivated Caryophyllaceae.]—*Z. PflKrankh.*, xl, no. 5, pp. 265–269, 2 figs. Stuttgart, May 1930.

Hylemyia (*Chortophila*) *brunnescens*, Zett., is recorded as mining the leaves of *Dianthus barbatus* in various places near Geisenheim a. Rhein.

Sélariès (E.). **Essais de lutte contre la mouche des cerises** (*Rhagoletis cerasi*).—*Prog. agric. vitic.*, xciii, no. 21, pp. 502–504, 1 ref. Montpellier, 25th May 1930.

This is an extract from a report of the Permanent Syndicate for the Protection of cultivated Plants of the Upper Rhine against Pests, which appeared in *Le Journal agricole d'Alsace-Lorraine.* An account is given of experiments carried out near Munster (Alsace) in controlling the adults of *Rhagoletis cerasi*, L. (cherry fruit-fly) by fixing in the cherry trees trap-branches dipped in a sweetened bait, which consists of 25 lb. glucose, 5 gals. water, and 1 lb. sodium arsenate, with the addition of some colouring substance, black, green or blue. A light shelter made of boards was arranged above the trap-branches to prevent the rain from washing off the bait. The branches were placed in the trees in the middle of May, and in the second half of June only a negligible percentage of the cherries was infested. At the same time the adult flies were very numerous, probably owing to the fact that the trap-branches were completely dry and had ceased to attract them. At the beginning of July 38 per cent. of the fruit was infested, but the larvae were abnormally small. It is thought that complete control might be obtained by renewing the trap-branches at the beginning and end of June.

Daviault (L.). **Notes biologiques sur** *Nemeritis canescens* **Grav. et sur la morphologie de ses divers stades.**—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 3, pp. 82–93, 5 figs., 8 refs. Paris, March 1930.

This account of the bionomics of the Ichneumonid, *Nemeritis canescens*, Grav., which is an important parasite of the Pyralid, *Ephestia kühniella*, Zell., in France, differs in some respects from those previously noticed [*R.A.E.*, A, xvi, 171 ; xvii, 329]. The author states that the female oviposits in mature larvae in their cocoons or in young pupae, the chitin of which is still soft enough to be penetrated by the ovipositor. The development from egg to adult at ordinary temperatures in the laboratory averaged 47 days, being never less than 40 nor more than 63 ; in an incubator at a constant temperature of 28° C. [82·4° F.], the life-cycle of a generation was completed in 27–30 days. The anatomy of the young and mature larva is fully described.

N. canescens is the most numerous parasite of *E. kühniella* in flour stores near Paris, but it is difficult to determine the extent of control exercised by it. Laboratory observations indicate that the reproductive capacity of the host (300 eggs per female) is 2½ or 3 times as great as that of the parasite, but two generations of the latter are produced to every one of the former. Theoretically, therefore, complete control should be possible, but this is never attained, as some of the host larvae occur inside the stored flour and are inaccessible to the parasite [xvii,

255]. Moreover, as the adults of *N. canescens* live for a very short time, their appearance does not always coincide with the period of maximum abundance of hosts that are in the susceptible stage.

Hibrauoi (M.). **Contribution à l'étude biologique et systematique de** *Eurygaster integriceps* **Put. en Syrie.**—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 3, pp. 97–160, 14 figs., 30 refs. Paris, March 1930.

This paper contains a review of the history of the Pentatomid, *Eurygaster integriceps*, Put., in Syria, Iraq, Russia and Turkey, and an account of its anatomy, classification, bionomics, economic importance and control [*cf. R.A.E.*, A, i, 446–451 ; xv, 14, xvi, 186, xvii, 442, 690]. A list is given of the known species of *Eurygaster*, showing the countries in which they occur, as well as a key to the Pentatomids sometimes associated with *E. integriceps* on cereals, which are not themselves pests of any importance. In Syria, the permanent foci of infestation are certain mountainous forest districts in the north. These should be kept under observation for the purpose of foretelling outbreaks, which usually occur every 18–20 years and last 6–8. The losses caused to cereals in recent years varied from 75 per cent. of the crop in 1925 to 7 per cent. in 1928–29 ; in 1924 the entire crop was destroyed in some localities.

The use of a poison bait is suggested to prevent the migration of the bugs from barley to wheat when the former has hardened. It should be exposed in containers sunk deeply in the ground in the infested field, so that the insects can enter them. A formula that proved effective in the laboratory is 6 oz. arsenic, 20 oz. molasses, 40 oz. wheat flour, and 7 pints of water, but more water would be required in the field, and it would have to be renewed constantly owing to evaporation. The author thinks that the bugs will readily feed on the bait during the hottest part of the day, when they descend the plants to shelter under the leaves. Other measures recommended are the removal and destruction of weeds [xvii, 290], particularly of *Leontice leontopetalum*, which is preferred for oviposition in Syria, and the arrangement of artificial hibernation quarters consisting of ditches filled with trap plants, from which the bugs could be collected in February and destroyed.

The author discusses the possibility of biological control and gives descriptions of the species of *Telenomus* that have been recorded in Russia [i, 449] and Iraq [xvii, 690] as egg-parasites of *E. integriceps*, with short notes on their bionomics. The two Tachinids found in Russia [i, 448] are considered of considerably less value. The fungus, *Isaria densa*, was observed in the laboratory in Syria to destroy the bugs, and sparrows and storks should be protected, as they devour large numbers. The methods by which the parasites might be introduced into Syria are described at length, and the possibility of utilising the fungus is discussed.

Hardy (F.). **Froghopper Incidence in 1929.**—*Min. & Proc. Froghopper Invest. Comm. Trinidad & Tobago*, pt. xviii, pp. 71–80. Trinidad, 1930.

In 1929 the first generation of the sugar-cane froghopper [*Tomaspis saccharina*, Dist.] appeared in Trinidad at least a fortnight earlier than in 1928 [*R.A.E.*, A, xvii, 531], nymphs being first observed on 25th May. An unusual feature of the outbreak in 1929 was the definite appearance

of a fourth generation during the last week in November and the first two weeks in December, the infestation being widespread but not intense; this generation was present on most estates until early January and continued in some districts until mid-February. Dusting with calcium cyanide succeeded in limiting froghopper incidence to the areas of infestation in 1928. Estates in the vicinity of abandoned land suffered considerably from re-infestation. Various light-traps were tried, but none proved to have any advantage over those previously in use. The second generation was very largely controlled in 1929 by the green muscardine fungus [*Metarrhizium anisopliae*], but hot weather in mid-September reduced the fungus and enabled the later generations of the froghopper to develop unhindered. Another fungus (*Empusa*), Syrphid flies and insectivorous birds all assisted in control, and jumping spiders (Attids) were more numerous than usual.

[**Miscellaneous Pests in Mexico.**]—*Bol. Divulg. Defensa agric., Sec. Agric. Fom., Mexico,* no. 11, 52 pp., 8 figs.; no. 12, 12 pp., 4 figs.; no. 13, 9 pp., 3 pls.; no. 14, 8 pp., 1 fig. S. Jacinto, D.F., 1929.

These popular bulletins are intended for the instruction of Mexican farmers. No. 11 describes methods for identifying and combating pests and diseases of cultivated plants; no. 12 deals with the control of *Lachnosterna* sp.; no. 13, with *Eriosoma lanigerum,* Hausm., on apple and its control; and no. 14, with the bionomics and control of *Phthorimaea operculella,* Zell. (potato moth).

Bruner (S. C.), Agete (F.) & Bouclé (L.). **Informe sobre tratamientos de habas de Lima verdes para destruir el insecto** *Maruca testulalis* (**Lepidoptera-Pyralidae**). [Report on Treatments of green Lima Beans against the Pyralid, *M. testulalis.*]—*Rev. Agric. Com. Trab.,* xii, no. 10, pp. 31–36, 2 figs. Havana, April 1930.

The experiments here described were made in Cuba to free green Lima beans [*Phaseolus lunatus*], intended for export in the pod to the United States, from the Pyralid, *Maruca testulalis,* Geyer. Vacuum fumigation with hydrocyanic acid gas proved unsatisfactory, but fumigation for 2½ hours in a 20-inch vacuum with 9 lb. carbon bisulphide to 1,000 cu. ft. seemed suitable for work on a commercial scale. The green pods are not injured, most of the larvae are killed at the time and the others die later. The effect on the pupae seems to be the same. The fumigation chamber is filled with the beans, and the temperature is maintained at or above 70° F. Exposure to cold appeared to be less practical than fumigation. Moist heat at 43·3–46° C. (110–115° F.) kills the larvae in 1½ hours from the time that all the beans have reached this temperature without damaging the latter.

Weber (G. A.). **The Bureau of Entomology, its History, Activities and Organization.**—*Service Monog. U.S. Govt.,* no. 60, xii+177 pp. Washington, The Brookings Institution, 1930. Price $1.50.

This is one of a series of monographs, prepared by the Institute for Government Research, giving a detailed description of each of the service departments of the Government of the United States. The

history, activities and organisation of the Bureau of Entomology are fully described. The publications of the Bureau, the laws governing its operations, its financial undertakings, and a bibliography of the literature dealing with its activities, are given in appendices.

WALTON (W. R.). **Cutworms on Golf Greens.**—*Bull. U.S. Golf Ass. Green Sect.*, ix, no. 9, pp. 156–157, 1 fig. Washington, D.C., September 1929.

Brief notes are given on cutworms causing damage to golf greens in the United States. They may be destroyed by spraying the turf with 2 lb. lead arsenate to 50 U.S. gals. water or by a poison bait consisting of 50 lb. wheat bran, 2 lb. Paris green or white arsenic, 2 U.S. qts. blackstrap molasses and 2 U.S. gals. or more of water. If bran is too expensive, it may be mixed with an equal quantity of fresh hardwood sawdust. Pine sawdust appears to act as a repellent. In diluting the mixture only 4–8 U.S. qts. water should be used. A formula suitable for smaller quantities of bait is 1 lb. Paris green or white arsenic, 1 peck dry bran, 1 U.S. pint molasses and 2–4 U.S. qts. water. Instructions for preparing the baits are given; the mash should be allowed to stand for several hours before being used.

FARQUHARSON (R. A.). **Locusts.**—*Ann. Agric. Rep. Somaliland Agric. Geol. Dept.*, 1929, pp. 24–30. London, Crown Agents for the Colonies, 1930.

This report includes detailed particulars of movements of swarms of *Schistocerca gregaria*, Forsk., over the Somaliland Protectorate in 1929. It is considered probable that although there are no permanent breeding grounds in that country, temporary breeding grounds, responsible for some of the swarms, had been formed in 1928. It is further suggested that enormous swarms observed on several occasions over Hargeisa, flying at a great height and with great rapidity in a southward direction may have originated in Arabia, which country may be responsible for the invasions of Abyssinia, northern Kenya and the Sudan.

Owing to the backward state of the Protectorate, only mechanical means of control, such as driving the hoppers into trenches and pits, trampling, etc., could be employed. The damage caused by the locusts was considerable, affecting the native crops and the grass of pasture areas.

FRAPPA (C.). **Au sujet des cochenilles du caféier dans la Province de l'Itasy.**—*Bull. écon. Madagascar*, xxvi, Partie Document., no. 1, pp. 7–13. Antananarivo, 1929.

Injury to coffee in Madagascar is caused by *Lachnodius greeni*, Vayssière, and *Coccus* (*Lecanium*) *viridis*, Green. A brief description of both species is given, with a short account of their bionomics and food-plants. *C. viridis* occurs on *Coffea canephora* and *C. liberica* as well as *C. arabica*, but the two former varieties appear to suffer less injury. Healthy and weakened plants are alike attacked, but only the latter show signs of serious damage. Infestation begins on the twigs and foliage and eventually spreads over the whole bush. *C. viridis* is invariably attended by ants. *L. greeni* has recently been

observed on the roots of *C. arabica* in one locality and on the collar and lower branches in others. In the Itasy district, however, it is found in masses of 30–50 at the leaf axils or along the branches.

The measures succesfully employed against these Coccids were spraying with a 5 per cent. kerosene emulsion or with lime-sulphur, the preparation of which is described, 2 lb. sulphur and 3 lb. lime being used to 80–100 gals. water. The lime-sulphur may be applied at double strength in the rainy season. Before spraying, the most seriously affected branches were cut off and burnt, and the spray was repeated after 15 days.

Proclamations under the Quarantine Act 1908-1924 in force on the 31st December 1929.—24 pp. Melbourne, Department of Health [1930].

This is an abstract of all the Australian proclamations and quarantines in force that deal with diseases and pests of man, animals and plants.

CORBETT (G. H.). **Entomological Notes. First Quarter, 1930.**—*Malayan Agric. J.*, xviii, no. 4, pp. 212–214. Kuala Lumpur, April 1930.

Brief notes are given on insect pests recorded in Malaya during the first quarter of 1930. Minor injury to tea was caused by *Helopeltis* sp. and *Agrotis ypsilon*, Hufn., the latter attacking the young seedlings only. On one estate *Brachytrypes portentosus*, Licht., was observed to cut off young tea seedlings. Spraying with lead arsenate may be employed against *Cephonodes hylas*, L., on coffee. In cases of serious infestation of this crop by *Stephanoderes* (*Cryphalus*) *hampei*, Ferr., the removal of all berries and the prevention of others from forming for at least six months is recommended. This measure reduced the infestation on one estate to about 2 per cent. The Reduviid, *Sycanus leucomesus*, Wlk., is recorded for the first time as attacking the larvae of *Setora nitens*, Wlk., on coconut. About 3 million individuals of *Trichogramma nanum*, Zehnt., were bred and liberated during January–March in Perak, for controlling moth-borers on rice.

GEE (N. G.). **Some further Notes on the Elm Moth.**—*Bull. Dept. Biol. Yenching Univ.*, i, no. 1, pp. 9–11. Peping, China, January 1930.

During the summer of 1928 most of the elms at Peping were defoliated by the larvae of a Lymantriid, closely allied to *Stilpnotia* (*Euzora*) *ochripes*, Moore, but probably a new species. Whole branches were killed and others so weakened as to become susceptible to attack by fungi and other insects. In some places the larvae dropping from the trees were so abundant that it was necessary to sweep them up two or three times a day, and by 10th September the moths were emerging in numbers. The following year, however, the insect could not be found.

Sarcophaga securifera, Villen., and *S. dux*, Thoms., were reared from the larvae in cages, and three unidentified Hymenopterous parasites were obtained from the pupae.

Sonan (J.). **A few Host-known Ichneumonidae found in Formosa (Hym.) (2).**—*Trans. Nat. Hist. Soc. Formosa*, xx, no. 108, pp. 137–144. Taihoku, Formosa, June 1930.

The species recorded are *Pimpla luctuosa*, Smith, obtained from *Clania minuscula*, Btlr.; *P.* (*Itoplectis*) *homonae*, sp. n., *Iseropus heichinus*, sp. n., *Anomalon discoidellum*, sp. n., *Eulimneria* (*Limnerium*) *homonae*, sp. n., and *Gambrus homonae*, sp. n., all from *Homona menciana*, Wlk.; *Nesopimpla narangae*, Ashm., from *H. menciana* and *Sesamia inferens*, Wlk.; *Cremastus biguttulus*, Munakata, from *Chilo simplex*, Btlr.; and *C. shirakii*, sp. n., which is the species recorded as *Apanteles simplicis*, Vier., by Shiraki [*R.A.E.*, A, v, 575], from *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.).

Tothill (J. D.), Taylor (T. H. C.) & Paine (R. W.). **The Coconut Moth in Fiji.**—Imp. 8vo, vii+269 pp., 1 map, 34 pls., 119 figs. London, The Imperial Institute of Entomology, 1930. Price 31*s*. 6*d*.

This monograph gives an historical account of the various methods undertaken by the Committee appointed by the Government of Fiji in 1924 for the control of *Levuana iridescens*, B.B., on coconut, and the results constitute a classical example of the successful control of a pest by biological methods.

The work carried out against this moth prior to 1925 is briefly reviewed, and the general arrangements of the campaign instituted in that year and carried on until January 1930 are described. In the absence of specific enemies of *L. iridescens*, it was necessary to study those attacking allied Zygaenids in Malaya, Java and the New Guinea Region with a view to introducing them. The greater part of the book is devoted to a morphological and biological study of *L. iridescens* and allied Zygaenids, and of the Tachinid, *Ptychomyia remota*, Aldr., and less important natural enemies, *L. iridescens* and the Tachinid being dealt with in very great detail.

A point of much interest is that parasites played no part in the natural control of the moth prior to the introduction of *P. remota* from Malaya. The factors that mainly conduced to the rapid spread of the Tachinid were its strong flying powers, the enormous numbers and overlapping broods of *L. iridescens*, and the absence of secondary parasites. The percentage of parasitism increased rapidly, and by January 1930 there had been no outbreak of the moth for three years. As a result of this work, the threat of disaster overhanging the islands by the loss caused to the coconut industry has been removed; they are now producing their normal crop of copra, and coconuts are being grown on the hitherto non-productive island of Vitu Levu. If, however, it should at any time prove necessary to utilise other parasites, the information obtained on their habits and distribution would make future importations a comparatively easy matter.

Jacques (C.). **Maladies parasitaires du cocotier.**—*Rev. agric. Nouv. Caledonie*, 1930, pp. 57–60. Nouméa, March 1930.

Brief notes are given on the damage caused to coconut palms in northern New Caledonia by the Hispid, *Brontispa froggatti*, Sharp

[*cf. R.A.E.*, A, xvii, 416]. A letter received from the Department of Agriculture of New South Wales recommends that the infested leaves and fronds should be sprayed with soap solution containing nicotine sulphate, 1 : 800. The author found nicotine without soap to be very effective when applied at 8 days' intervals. Lead arsenate, 1 lb. to 10 gals. water, did not adhere to the leaves, even though lime was added.

Acqua (C.). **Il bombice del gelso.** [The Mulberry Silkworm.]—Med. 8vo, xiii+552 pp., 128 figs. Ascoli Piceno, G. Cesari, 1930. Price *Lire* 60.

This monograph is based on the author's own observations, made in the course of many years' work on *Bombyx mori*, L., supplemented by references to the more important investigations of others. The morphology and development of the various stages are discussed, with a chapter on hybrid races. An account is also given of the various diseases of the silkworm, and of the technical methods involved in obtaining and storing the cocoons.

Report of the Third Imperial Entomological Conference, 17-27th June 1929.—Med. 8vo, 59 pp. London, The Imperial Institute of Entomology, 1930. Price 2*s.* net.

At this Conference, which was attended by 37 delegates, an announcement was made that the Imperial Bureau of Entomology will in future be known as the Imperial Institute of Entomology. Among the more important resolutions passed at the Conference was one to the effect that there should be an appreciable increase in the annual contributions placed at the disposal of the Managing Committee, if the present standard of efficiency of the Institute is to be maintained, in order that it may be in a position to cope with the increase in work and responsibility that falls upon it. The Conference also emphasised the necessity in the interests of continuity in the entomological work in the British Empire of means being devised to place the Institute on an assured and permanent basis.

Appendices contain details of the work of the Institute from April 1925 to March 1930, and of its organisation and estimated annual expenditure. Summaries are given of the discussions at the scientific meetings of the Conference, the subjects dealt with being: The Organisation of Entomological Departments; Entomological Work among Backward Races; Tsetse Control; the Control of Insects by Cultural Methods; Locusts; The Biological Control of Insects; The Control of Weeds by Insects; and the Control of Orchard Pests.

Papers noticed by Title only.

Knight (H. H.). **"Alfalfa Plant-bug," a common Name for an introduced European Bug** (*Adelphocoris lineolatus* **Goeze**) **found in Iowa (Hemiptera, Miridae).**—*J. Econ. Ent.*, xxiii, no. 2, pp. 331–334. Geneva, N.Y., April 1930. [See *R.A.E.*, A, xviii, 273.]

MARCOVITCH (S.) & STANLEY (W. W.). **Two arsenical Substitutes.** [Cryolite and Barium Fluosilicate.]—*J. Econ. Ent.*, xxiii, no. 2, pp. 370–376. Geneva, N.Y., April 1930. [*Cf. R.A.E.*, A, xviii, 222.]

STURTEVANT (A. P.). **Preliminary Report concerning Factors related to certain of the Growth Phases of** *Bacillus larvae*.—*J. Econ. Ent.*, xxiii, no. 2, pp. 453–459, 11 refs. Geneva, N.Y., April 1930.

FOLSOM (J. W.) & BONDY (F. F.). **Calcium Arsenate Dusting as a cause of Aphid Infestation** [*Aphis gossypii*, Glov., on Cotton].—*Circ. U.S. Dept. Agric.*, no. 116, 11 pp. Washington, D.C., April 1930. [For abridged account see *R.A.E.*, A, xvi, 268.]

YETTER, jr. (W. P.). **Studies of Bait Traps for the Oriental Fruit Moth** [*Cydia molesta*, Busck].—*Trans. Illinois Hort. Soc.*, lxiii, pp. 441–443. Centralia, Ill., 1930. [*Cf. R.A.E.*, A, xviii, 388.]

GRANOVSKY (A. A.). **A new Name for the Genus** *Quippelachnus* **Oestlund (Aphiidae, Homoptera).**—*Proc. Ent. Soc. Wash.*, xxxii, no. 4, pp. 61–64, 9 figs., 13 refs. Washington, D.C., April 1930.

SACHAROV (N. L.). **Studies in Cold Resistance of Insects.**—*Ecology*, xi, no. 3, pp. 505–517, 7 refs. Brooklyn, N.Y., July 1930. [*Cf. R.A.E.*, A, xvii, 126.]

FULMER (H. L.). **Insecticides, Fungicides and Herbicides.**—*Bull. Ontario Dept. Agric.*, no. 351, 78 pp., 1 fig., 13 refs. Toronto, April 1930. [*Cf. R.A.E.*, A, xii, 34.]

BUEKER (E. D.). *Phenacoccus wilmattae* **Ckll.**—*Canad. Ent.*, lxii, no. 4, pp. 93–94, 1 figs., 2 refs. Orillia, Ont., April 1930.

MUNRO (J. W.). **Beetles injurious to Timber.**—*Bull. Forestry Comm.*, no. 9, 30 pp., 6 pls., 20 figs. London, H.M.S.O., 1930. Price 1*s*. 3*d*. [Reprint, *cf. R.A.E.*, A, xvi, 183.]

TRÄGÅRDH (I.). **Methods of investigating the Fauna of dying Trees.**—*Proc. Internat. Cong. Forest. Exptl. Sta., Stockholm 1929*, pp. 644–652, 5 figs., 4 refs. Stockholm, 1930. [*Cf. R.A.E.*, A, xv, 271 ; xviii, 317.]

ZOLK (K.). **Zur Bekämpfung des Meerrettich-Blattkäfers** (*Phaedon cochleariae* **Fbr.**) **mit Arsenstäubemitteln.** [Work against the Mustard Leaf-beetle with arsenical Dusts.]—*Tartu Ulikooli Entomoloogia Katsejama Teadaanded*, no. 8, 16 pp., 7 figs. Tartus, 1929. (With a Summary in German.) (Abstract in *Zbl. Bakt.*, (2) lxxxi, no. 1–7, p. 153. Jena, May 1930.) [*Cf. R.A.E.*, A, xviii, 432.]

GREEN (E. E.). **A new Species of** *Phenacoccus* [*tomlini*] **(Coccidae) from the Eastern Alps** [Italian Tyrol].—*Ann. Mag. Nat. Hist.*, (10) v, no. 27, pp. 320–322, 6 figs. London, March 1930.

KALSHOVEN (L. G. E.). **De biologie van de djatitermiet** (*Kalotermes tectonae* **Damm.**) **in verband met zijn bestrijding.** [The Biology of the Teak Termite (*Calotermes tectonae*) in Java in Connection with its Control.]—*Meded. Inst. PlZiek.* no. 76, 154 pp., 20 pls., 9 figs., 54 refs. Buitenzorg, 1930. (With a Summary in English.) [See *R.A.E.*, A, xviii, 286.]

CHRYSTAL (R. N.). **Studies of the *Sirex* Parasites. The Biology and post-embryonic Development of *Ibalia leucospoides* Hochenw. (Hymenoptera-Cynipoidea).**—*Oxf. For. Mem.*, no. 11, 63 pp., 10 pls., 7 figs., 63 refs. Oxford Univ. Press ; London, Humphrey Milford, 1930. Price 5*s.*

This is an account of studies made during the past three years in England on the biology of *Ibalia leucospoides*, Hochenw., a parasite of the wood-wasp, *Sirex cyaneus*, F., and contains a historical review of the European and American literature on the subject. All stages of this Cynipid are described, and its systematic position and the morphology of the antennae, reproductive system of the female, ovipositor, egg and larval instars are discussed. Some of the information on its life-habits has already been noticed [*R.A.E.*, A, xvi, 652]. In the field the adults are on the wing and oviposit from August to mid-October, at which period *S. cyaneus* is also in flight ; on one occasion a female emerged as late as December from logs stored in a cage in the laboratory. In the open the males are much less often observed than the females, but laboratory observations seem to indicate that the numbers of the sexes are about equal. The pairing and oviposition habits are described. As the host is parasitised in the oviposition tunnel, the presence of the parasite serves to indicate infestation of trees on which no exit holes of the pest can be found. Field observations on one occasion suggested that *I. leucospoides* may also parasitise the eggs and young larvae of *S. gigas*, L. The host larva is never parasitised after it has begun to bore away from the egg-tunnel, and parasitised larvae hardly ever burrow deeper than the sapwood, the length of tunnel that they make averaging 2–3 ins., with a maximum of 6–7. Although 2 or 3 eggs are usually laid in one host larva, only one parasite reaches maturity.

Observations indicate that the life-cycle of *I. leucospoides* occupies at least 3 years, the egg-stage lasting from 6 weeks to almost a year, the larval stage about 3 years (for almost two-thirds of this time the parasite remains within the body of the host), and the prepupal and pupal stages a maximum of 2 months. Examination of the larvae of *S. cyaneus* taken from larch logs in three localities indicated that in any area where *Ibalia* is common, the percentage of parasitism should reach 25–30 per cent.

The interrelation of *I. leucospoides* and *Rhyssa persuasoria*, L., the Ichneumonid parasite of *Sirex*, is discussed. Only one record of a case of actual hyperparasitism has been obtained [xvii, 158], but, contrary to a previous statement [xvi, 653], observations have shown that the larvae of *S. cyaneus* parasitised by *I. leucospoides* are sometimes also parasitised by *R. persuasoria* ; in most cases they are even more vulnerable than normal larvae by reason of their superficial situation in the wood. It follows that in districts where one parasite is abundant, the other may be expected to occur sparingly. In the event of both these parasites being sent to New Zealand, it would therefore be advisable to liberate them in different regions.

ADKIN (R.). **Notes on the Life-history of *Cydia* (*Carpocapsa*) *pomonella*, L.**—*Proc. S. Lond. Ent. Nat. Hist. Soc.*, 1928–29, pp. 24–29, 1 pl., 6 refs. London, 1929.

Previous observations on the biology of *Cydia pomonella*, L., published in England are briefly reviewed. These accounts, some of

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which are apparently based on observations made in other countries, all appear to indicate that the blossoming and oviposition periods coincide fairly closely, and that either the egg is laid in the calyx of the immature fruit, or that the larva on hatching enters the fruit through the calyx.

The author's own observations were conducted chiefly on the ripening fruit and the full-fed larvae. The infested fruit begins to fall about the middle of August. The fruits usually fall during the night, and the larvae probably leave them at once. Examination of infested apples suggests that the larvae usually enter the fruit at the side, though sometimes they may enter through the calyx, either because of the position of the fruit or because of the toughness of the skin. In favourable seasons *C. pomonella* has two generations a year. Larvae of the second generation enter the fruit at the side and are not full-fed until the latter half of September.

Schoevers (T. A. C.). **Appelwantsen en hunne bestrijding.** [Apple Bugs and their Control.]—*Tijdschr. Plantenz.*, xxxvi, no. 4, pp. 75–83, 1 pl. Wageningen, 1930.

An account is given of the Capsids, *Plesiocoris rugicollis*, Fall., and *Lygus pabulinus*, L., as pests of apple in Holland. The former oviposits in the bark in late June and July, and the eggs hatch in the following April or May, nymphal development requiring about 6 weeks. The data given on the bionomics of *L. pabulinus* differ little from those recorded in England [*R.A.E.*, A, xvi, 619]. Winter spraying with carbolineum has given good control ; some failures that have occurred are ascribed to the eggs being deposited at a great depth in the bast. Experiments are being made with two Dutch preparations resembling the Long Ashton washes [xviii, 176, etc.] successfully used in England. A spray of nicotine and soap [xvi, 423], applied ten days before the apple is in full blossom, proved effective against *P. rugicollis*.

Becker (—). **Die *Tipula* und ihre Bekämpfung.** [*Tipula* spp. and their Control.]—*Mitt. der DLG.*, 1929, no. 44, pp. 67 *et seq.* (Abstract in *Z. PflKrankh.*, xl, no. 6, p. 295. Stuttgart, June 1930.)

In the district around Eutin, Oldenburg, white clover is the preferred food-plant of the larvae of *Tipula* spp. Peas and buckwheat are also readily attacked. Barley is preferred to oats, but all field and garden plants, and even pine seedlings, are liable to infestation, though *Agrostis*, *Plantago* and *Rumex* are avoided. The measures recommended are the encouragement of insectivorous birds, and the use of bran baits poisoned with Paris green or sodium fluosilicate, or of kainit dust applied in the evening in dry weather at the rate of about 600–800 lb. per acre.

Riols (P.). **Le ver du crosne** (*Argyroploce antiquana* **Hb.) parasite nouveau pour la région de l'Est.**—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 4, pp. 161–163, 2 refs. Paris, April 1930.

Argyroploce antiquana, Hb., is recorded, apparently for the first time in France, as attacking the tubers of Japanese artichokes [*Stachys tubifera*] at St. Mihiel and in the neighbourhood of Orléans. The injury first becomes apparent in November and increases rapidly until

December, the time of harvesting the tubers. At St. Mihiel half the crop was lost. In Switzerland, where the losses caused are estimated at over 75 per cent. of the crop, the measures advocated are the immersion in water of the tubers harvested in November, as the infested ones float and can be destroyed ; treatment of the soil with carbon bisulphide at the rate of 1 oz. to 4–5 sq. ft. ; and the use of a repellent for the moths, such as powdered naphthalene, scattered on the soil at the rate of 180–260 lb. to the acre.

PUSSARD (R.). **Les anthonomes du poirier dans la vallée du Rhône.**—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 4, pp. 164–173, 4 figs., 9 refs. Paris, April 1930.

An account is given of the three species of *Anthonomus* attacking pear in the Rhône valley, *viz.*, *Anthonomus pomorum*, L., *A. cinctus*, Redtb., and *A. spilotus*, Redtb., and the distinguishing characters of each species are briefly enumerated. The adults of *A. pomorum*, which attacks the flower buds of apple and pear, appear in the last half of April in the Avignon region. This weevil is generally abundant throughout the south. *A. cinctus* is more common in the north, but causes serious injury in pear orchards in the neighbourhood of Lyons. The eggs are laid in autumn in the developing fruit buds. The larvae develop within the buds during the winter ; most of the buds are completely destroyed, but in about 20 per cent. partial atrophy is followed by incomplete development of the inflorescence in April. Pupation occurs in April, and the adult emerges at the end of the month or the beginning or May. Parasitism is very low, only one parasite, a male of the Ichneumonid, *Clistopyga incitator*, F., being obtained from several thousand infested buds. Of these, 15 per cent. contained dead larvae or pupae, possibly killed by disease.

A. spilotus, although common in many parts of France, is recorded for the first time in the Rhône Valley. In the neighbourhood of Lyons this weevil was found to attack equally the leaf, fruit and flower buds, and the young foliage. Oviposition occurs from late March to early May. At the beginning of this period, when the buds begin to open, the female makes feeding and oviposition punctures, amounting to as many as 7 or 8 to a bud, and these cause general atrophy and premature blackening of the flower buds. Oviposition in an unopened fruit bud results in complete atrophy of the flower buds in which the eggs have been deposited ; the adult weevils produced are, however, of a small size. If oviposition takes place in a more advanced bud, the young larva locates itself in the upper part of the ovary, which it partly devours, and causes asymmetrical development. The main attack, however, is directed against the foliage. The eggs are laid on leaf buds just about to open, on the edges of the young leaves rolled parallel to the midrib. Many feeding punctures are also made, and these have a stunting effect on the leaves, even checking the development of larvae hatching on them by depriving them of nourishment. Pupation occurs at the end of May and beginning of June. The adults emerge about the middle of June, but then appear to remain inactive until the following spring. Fifty leaves bearing pupae of *A. spilotus* or showing characteristic injury were examined and the insects bred from them : 11 per cent. produced adult weevils ; 9 per cent. yielded *Microbracon* (*Bracon*) *discoideus*, Wesm. ; 37 per cent. yielded the Pteromalid, *Habrocytus tenuicornis*, Först. ; 15 per cent. contained

dried larvae, possibly killed by disease; and 28 per cent. showed no traces of larvae remaining, probably owing to the attacks of birds, which are often seen in the orchards.

The only method of controlling these three weevils is the hand collection of infested buds and of pupae from blossoms and foliage followed by either immediate destruction or breeding out of parasites. The use of mineral oil winter washes might kill a small proportion of the adults hibernating under the bark, or, applied at the proper time, might act as a repellent to oviposition.

Mesnil (L.). **Nos connaissances actuelles sur les Elaterides nuisibles en France.**—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 4, pp. 178–204, 3 pls., 40 refs. Paris, April 1930.

This is a review from the literature of present knowledge of the biology, economic importance and control of Elaterids, supplemented by the author's observations in France.

The life-history appears to be identical in all the species. All those observed by the author appear to be carnivorous in the adult stage, with the exception of the three species of *Agriotes* (*A. lineatus*, L., *A. obscurus*, L., and *A. sputator*, L.) which, in the absence of animal food, were seen to attack the leaves of cereals. The method of oviposition is described. Numerous and careful observations confirm that the eggs hatch between 10th and 14th July, irrespective of the species. The young larvae at first appear to feed entirely on detritus and develop extremely slowly. The complete duration of the larval stage has not been determined. The larvae are extremely susceptible to heat and burrow deep into the soil to avoid it. Humidity is a factor of secondary importance, moist soil being more favourable because it is cooler, though excessive humidity appears to be unfavourable. When immersed in water, the larvae die in a few days. The largest larvae, which cause the greatest amount of damage, go through their last moult in May and descend to a depth of 6–13½ inches to pupate without any further feeding. They usually remain about 6 weeks in the pre-pupal stage, pupating at the end of June. The adults develop a month later but do not leave the pupal cell until the following April. A careful examination showed distinct morphological differences between the larvae of *A. sputator* and those of *A. lineatus* and *A. obscurus*, although none of the differences recorded by other authors between the two latter species could be found, these larvae being apparently identical.

The recognised methods against wireworms are discussed. A measure that is to be tested is the cultivation of a prolific variety of potatoes in infested soil. It is believed that these will attract all the wireworms present, and they can then be carefully eliminated from the soil and fed to pigs.

Guyot (A. L.). **Quelques observations sur les taupins.**—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 4, pp. 207–212, 4 figs. Paris, April 1930.

The position of areas found to be infested by Elaterids in an experimental field of wheat in northern France is discussed in relation to the type of soil. Particulars are given of the crops planted in the field during the past 7 years. It was divided into parallel strips, some of which were fertilised with sodium nitrate, and on one side was an area

consisting of plots that were completely fertilised, complete fertilisation consisting of the application of potassium nitrate and ammonium phosphate (1 : 1), potassium nitrate and sodium nitrate (30 : 37), or ammonium phosphate and sodium nitrate (10 : 9). Infestation occurred in patches on the strips treated with sodium nitrate and those that had received no treatment, and was completely absent in the area that had received complete fertilisation though it extended up to the edge of it along a straight line about 43 yards long. The most serious centres of injury, in which the wheat had almost disappeared in consequence of the infestation, were consistently situated along a strip that had received heavy fertilisation with sodium nitrate alone on 5th and 6th February. The infested patches were all localised, with one exception, on the area that maintained the highest degree of humidity during a particularly dry period in March and April, which corresponded with the greatest activity of the Elaterid larvae. Wireworms were rare or non-existent in the two areas that dried more rapidly during this period.

Buxton (P. A.). **Evaporation from the Meal-worm** (*Tenebrio*: **Coleoptera) and atmospheric Humidity.**—*Proc. Roy. Soc.*, (B) cvi, no. B.747, pp. 560–577, 8 figs., 6 refs. London, August 1930.

The following is the author's summary: The paper discusses the results obtained by keeping larvae of *Tenebrio molitor*, L., at 23 and 30° C. [73·4 and 86° F.] and in atmospheres of various humidities. Even in dry air and at 30° C. fasting larvae generally live a month. Metabolism must therefore be low, and this is shown to be the case by weighing the daily production of CO_2 from fasting larvae kept in dry air. Loss of weight of larvae is therefore very nearly the same as loss of water. It is not possible to produce a standard mealworm with a constant proportion of water in it. The loss of water from a fasting mealworm is complex. For humidities below 90 per cent., the loss is nearly identical in larvae kept at 23 and 30° C. at the same saturation deficiency. But neither saturation deficiency nor any other measure of atmospheric humidity explains the loss at several humidities and any one temperature. It seems that there is a definite limit to the amount of water which a larva can lose in a day; also that in nearly saturated air the larva produces more water of metabolism than it can get rid of. It is shown that the larva can maintain the proportion of water in its body nearly constant, during a month's fast, at humidities from 0 to 60 per cent. It appears that it is able to do this by consuming some stored substance and holding the water produced in metabolism.

Howard (L. O.). **Man and Insects.**—*J. Maryland Acad. Sci.*, i, no. 2, pp. 84–89. Baltimore, Md., April 1930.

In this general review of the growing menace from insect pests, the author insists on the necessity of expanding and concentrating human effort upon their control with a view to preserving sufficient food supplies for the increasing population of the world.

BRUES (C. T.). **The Food of Insects viewed from the biological and human Standpoint.**—*Psyche*, xxxvii, no. 1, pp. 1–14. Boston, Mass., March 1930.

The author discusses the various types of feeding habits in insects, the lines on which they may have evolved, and the way in which the activities of oligophagous and monophagous species affect the growth and development of plants. The economic importance of insects and the increasing complexity of the problem of preventing their spread to new areas under modern conditions of trade and transport are also briefly reviewed.

THOMPSON (W. R.). **The biological Control of Insect and Plant Pests. A Report on the Organisation and Progress of the Work of Farnham House Laboratory.**—*E.M.B.*, 29, 124 pp., 8 pls., 8 pp. refs. London, H.M. Stationery Office, June 1930. Price 1*s*. net.

This report includes a valuable account of the principles and organisation of work in biological control, dealing with preliminary field surveys, the examination of sample collections, the choice of beneficial species, the arrangement of large scale collections and shipments, the methods of treatment and reception, the study of the progress of introduced parasites in the field and the results of experiments. A history is given of the inauguration, resources, equipment and staff of Farnham House Laboratory, which was founded by the Imperial Institute of Entomology in 1927 with funds provided by the Empire Marketing Board ; and the work hitherto accomplished and the problems at present under investigation are discussed.

IMMS (A. D.). **Observations on some Parasites of** *Oscinella frit* **Linn. Part I.**—*Parasitology*, xxii, no. 1, pp. 11–36, 14 figs., 29 refs. London, 1930.

Detailed descriptions are given of the adults of the Chalcid, *Halticoptera* (*Dicyclus*) *fuscicornis*, Wlk., the Cynipid, *Eucoila* (*Rhoptromeris*) *eucera*, Htg., and the Proctotrupid, *Loxotropa tritoma*, Thoms., which were reared from the first generation of puparia of *Oscinella frit*, L., in the stems and leaves of spring oats in the Harpenden district, England. They have also been reared in the Leeds and Oxford districts by other observers. The rate of parasitism was 27 per cent. in 1926 and 37 per cent. in 1927 ; *E. eucera* was the dominant species, *L. tritoma* being comparatively rare. The host is attacked in the larval stage. Observations indicate that the parasites collectively become more abundant as the season advances, with the result that *O. frit* is much more heavily parasitised in late sown oats than in oats drilled earlier in the season. The time of maximum emergence of *O. frit* in rearing cages in the open during 1926 and 1927 coincided very closely with its period of greatest abundance in the field [*R.A.E.*, A, xii, 284].

Records of the hosts of various species of *Halticoptera*, *Eucoila* and *Loxotropa* are reviewed from the literature, and a list of the known parasites of *O. frit*, showing their synonymy and distribution, is appended.

Niblett (M.). *Coeliodes cardui*, **Hbst., a Garden Pest.**—*London Nat.*, 1929, p. 46. London, 1930.

Stenocarus (*Coeliodes*) *cardui*, Hbst., is recorded from Surrey as causing severe injury to *Papaver nudicaule* (Iceland poppy). The larvae of this weevil bore in the lower part of the stem from the root up, but not in the root itself, causing the leaves to wither and eventually killing the plant.

Smith (K. M.). **Insects in Relation to Potato Virus Diseases.**—*J. Minist. Agric.*, xxxvii, no. 3, pp. 224–232, 4 pls. London, June 1930.

Although biting insects may transmit virus diseases of other crops, it is sucking insects that are concerned in the transmission of potato viruses. Three main types of sucking insects attack the potato plant, Capsids, leafhoppers and Aphids, and experiments have shown [*R.A.E.*, A, xv, 200 ; xvii, 496] that of these insects *Myzus persicae*, Sulz., is the only vector of any importance. The mere feeding of Capsids on the plants causes the destruction of the young shoots and produces a "shot-hole" effect on the older leaves, but this condition is due to certain toxins in the insects' saliva, and has no connection with virus disease. *M. persicae* is exceedingly common and is able to feed on many plants of widely differing families, and besides transmitting no less than five diseases of potato, is also concerned in the transmission of viruses of other plants. Both winged and wingless forms can carry infection. The mechanism by which the virus is transmitted by the Aphid is discussed; in the case of leaf-roll, which cannot be transferred by needle, the virus may have to undergo some slight modification in the body of the Aphid before it becomes infective to a new plant [*cf.* xvii, 497]. Thus Aphids from infected plants can transmit leaf-roll to healthy potatoes in 2 hours, and Aphids can pick up the virus from an infected plant in 6 hours, but the whole process of infection of the Aphid and the healthy plant cannot be performed in 8 hours. There appears to be a minimum period of about 54 hours before the non-infective Aphid can become infective. This may mean that there is some relationship between the virus and its insect carrier, or it may merely be the time necessary for the virus to travel round the body of the insect and return through the salivary juices. *M. persicae* also feeds on the sprouts of "seed" potatoes, and by feeding infective Aphids on known healthy tubers in February a crop of plants badly infected with leaf-roll was produced at the end of March. Thus the virus may become distributed to a considerable extent among sprouted tubers, and healthy "seed" tubers may become infected before they are planted in the ground.

Certain varieties of potatoes react abnormally to virus diseases, and although outwardly healthy, carry in their sap one or more of the viruses. It is thus possible that such "carrier" plants may act as reservoirs of the disease in nature. So far no variety of potato has been found to be immune from virus diseases, though there exists a wide range in varietal susceptibility and in reaction to different diseases [*cf.* xviii, 499]. It has also been found that *Solanum nigrum* is not only frequently infected with potato viruses, but also exhibits practically no symptoms other than a faint mottling of the leaves, which disappears with the

continued growth of the plant. It is a common food-plant of *M. persicae*, and, in this case at least, it has been proved that the Aphid can transmit infection from a "carrier" plant to healthy susceptible varieties of potato. In one instance a single winged female, transferred from *S. nigrum* in the field, was sufficient to infect a healthy potato plant with crinkle and streak disease and render it entirely useless for tuber production.

It is thought that one of the chief reasons for the freedom of much Scottish "seed" from virus disease is the relative scarcity of the Aphid vector in Scotland. It is therefore suggested that if healthy tubers could be raised in England under insect-free conditions, the problem of supplying English growers with satisfactory home-grown "seed" would be solved. Regarding the prevention of infestation among sprouting tubers in seed trays by *M. persicae*, it is recommended that the shed containing the trays should be fumigated twice a week with a small quantity of pure nicotine in a metal saucer heated over a spirit lamp. In the field, diseased plants should be "rogued" out as soon as symptoms appear, but this method is only practicable with a disease such as leaf-roll, where the symptoms are easily recognisable and where the complications of "carriers" with suppressed symptoms are less likely to occur.

WHITEHEAD (T.). **Transmission of Potato Leaf-roll.**—*Nature*, cxxv, no. 3165, pp. 974–975. SMITH (K. M.). *Op. cit.*, cxxvi, no. 3168, p. 96. WHITEHEAD (T.). *T.c.*, no. 3172, pp. 241–242. London, June–August 1930.

In the first of these three letters, Whitehead states that he has found *Myzus circumflexus*, Buckt., to be an efficient vector of potato leaf-roll in experiments in winter and spring, and gives reasons for considering it a suitable species for work in virus transmission. Smith states that he has found it a poor transmitter of potato mosaic and that its saliva contains a toxin, with the result that the feeding alone produces a false mosaic. Whitehead agrees that *M. circumflexus* is of little importance as an active agent in spreading virus diseases and does not wish to minimise the status of *M. persicae*, Sulz., in this connection, but points out that false mosaic symptoms would not complicate experiments with leaf-roll.

Lyctus **Beetles and their Control.**—*Leafl. For. Prod. Res. Lab., Dept. Sci.Ind. Res.*, no. 3, 4 pp., 3 figs. London, 1930.

A general account is given of the biology and control of beetles of the genus *Lyctus* [*R.A.E.*, A, xvi, 185; xvii, 254], of which at least four species now occur in Britain. Timber in stock should be regularly inspected twice a year, in March and October, and attention should be given throughout the year to any susceptible timber introduced into the stock. Any infested material should be isolated, and infested sapwood should be removed and destroyed. Sapwood should be eliminated so far as possible from timber used in building, furniture, etc.

Massee (A. M.). **The Occurrence of a Tarsonemid Mite upon the cultivated Strawberry in England.**—*Gdnrs.' Chron.*, (3) lxxxvii, no. 2250, pp. 110–111, 1 fig., 11 refs. London, 8th February 1930.

Tarsonemus fragariae, Zimm., has been observed during the last two years damaging cultivated strawberries in England. The history of the mite in other European countries is reviewed, and the characters by which it may be readily distinguished from allied species are given. It is smaller than *Tetranychus telarius*, L., and has probably been introduced with consignments of strawberries from the Continent. The eggs are deposited on the leaves and among hairs on the petioles, twenty or thirty sometimes being found on one leaflet. All stages may be observed on the same leaf during late summer. The mites are found in between the folded leaves, on the lower surface of young foliage and in the crevices of the crowns of the plants, always avoiding the sunlight. Where they have been feeding for some time, the leaves become dotted with small black marks. It is not yet known to what extent the plants are affected, but further observations are being made.

[Spessivtzev (P. N.).] Spessivtseff (P.). **Ueber die Generationsdauer und forstwirtschaftliche Bedeutung der in schwedischen Wäldern verbreiteten** *Pityophthorus micrographus* **L.,** *Polygraphus poligraphus* **L. und** *Polygraphus subopacus* **Thoms.** [On the Duration of Generations and Importance of *P. micrographus*, *P. poligraphus* and *P. subopacus* distributed in Swedish Forests.]—*Proc. Int. Cong. Forest. Exptl. Sta. Stockholm 1929*, pp. 678–682, 1 fig., 2 refs. Stockholm, 1930.

These continued investigations on the bark-beetles of Sweden [*cf. R.A.E.*, A, xiii, 464 ; xvii, 57] deal with four species attacking spruce that normally hibernate as larvae, *viz.*, *Polygraphus poligraphus*, L., *P. subopacus*, Thoms., *Pityophthorus micrographus*, L., and *P. trägårdhi*, Spess.

The two species of *Polygraphus* oviposit in the first half of July, and the larvae begin to pupate early in the following June. They are usually associated with *Ips typographus*, L., as secondary pests that hasten the death of the tree, but sometimes do occur independently. In August 1925 fresh galleries of *P. poligraphus* were seen under the bark of a tree 95 years old in an unmixed stand of spruce, and in September the crown began to turn yellow. After felling in 1926, most of the pupae and numerous young adults were found on 25th June at a height of 23 ft. ; the latter were also abundant on 12th July, but examination of other samples of the bark showed larvae to be absent. Blocks infested with pupae and adults were placed with fresh logs suitable for breeding or fastened on the trunk of an unhealthy tree, and by mid-August the galleries of the young beetles were found in the logs and trunk.

Pityophthorus micrographus is very common in spruce forests in Scandinavia, Finland, Russia and West Siberia, but is rare in western Europe, being replaced by *P. pityographus*, Ratz. It occurs almost always in association with *Ips typographus*, infesting the trees a few days after the latter. Very often this combined attack is followed, but not before July, by infestations of *Polygraphus poligraphus* or *P. subopacus*. Sometimes *Pityophthorus micrographus* does not follow *Ips typographus*

until the following year. It may also happen that trees infested by *Polygraphus* are attacked by *Pityophthorus micrographus* in the following year. The latter attacks weak pole-wood as well as old trees. It develops very slowly, hibernating first as a larva and in the second winter as a young adult under the bark of the same tree. *P. trägårdhi* flies at about the same time as *P. micrographus*, but bores in the very thin branches of standing spruce, which soon wither. Both species appear to be more harmful than *Ips* (*Pityogenes*) *chalcographus*, L., as they attack standing trees exclusively, whereas *I. chalcographus* breeds in fallen branches. Injury by all bark-beetles in Sweden is, however, of secondary importance owing to the adoption of sylvicultural methods that do not disturb the balance of nature.

Saalas (U.). **Verheerungen von** *Panolis griseovariegata, Blastophagus piniperda* **und** *Bl. minor* **im Valkjärvi (Finnland).** [Injurious Outbreaks of *P. flammea, Myelophilus piniperda* and *M. minor* in the Valkjärvi District, Finland.]—*Ann. Soc. Zool.-Bot. Fenn. Vanamo*, viii, no. 9, pp. 168–180, 3 figs. Helsingfors, 1929. (With a Summary in Finnish.)

In the state forests of Finland the most serious pests of pines are *Panolis flammea*, Schiff. (*griseovariegata*, Goeze) and the bark-beetles, *Myelophilus* (*Blastophagus*) *piniperda*, L., and *M.* (*B.*) *minor*, Htg., which follow the attacks of the moth. In July 1925 over 2,200 acres were infested by *Panolis*. Many pines were defoliated, and also several young spruces and junipers. The woods that suffered most had a fairly thick carpet of moss, the trees being uninfested where the ground was either bare or closely covered with heather, lichen, etc., or where the soil was very damp. Up to 46 pupae per square yard were found immediately beneath the moss, but few or none where the brushwood was dense.

From some 3,000 pupae, 730 moths, 540 Hymenopterous parasites and 325 Tachinids, probably *Ernestia rudis*, Fall., were obtained. The Hymenoptera included *Ichneumon* spp., *Meteorus albiditarsis*, Curt., *Aphanistes armatus*, Wesm., *Henicospilus ramidulus*, L., *Tylocomnus scaber*, Grav., *Pimpla examinator*, F., and *P. arctica*, Zett. Egg-parasites were not examined ; but in the spring of 1926 almost all the eggs laid by the surviving moths were parasitised, and the outbreak came to an end. *Myelophilus piniperda* and *M. minor*, however, increased in the trees weakened or killed by *P. flammea* and rendered felling on a large scale inevitable.

Balachowsky (A.). **Contribution à l'étude des coccides de France (3e note). Coccides nouveaux ou peu connus de la faune de France.**—*Bull. Soc. ent. Fr.*, 1930, no. 10, pp. 178–184, 9 figs., 7 refs. Paris, 1930.

This annotated list of Coccids found in France includes a record of the discovery of *Phoenicococcus marlatti*, Ckll., on old date palms at Antibes, this species apparently having been introduced from north Africa some time ago.

CHEVALIER (L.). **Etude sur un Hyménoptère mangeur de chenilles,** *Cratotrechus larvarum,* **L.**—*Bull. Soc. Sci. Seine-et-Oise,* (2) xi, no. 2, pp. 28–31. Versailles, 1930.

Cratotechus larvarum, L., was found to be locally abundant as a parasite of the larvae of *Polia* (*Hadena*) *oleracea*, L., and *Barathra* (*Mamestra*) *brassicae*, L., in France.

JACQUET (J.). *Peritelus sphaeroides* **et ses dégâts dans les pépinières.**—*Bull. bimens. Soc. linn. Lyon,* ix, no. 11, pp. 75–76. Lyons, 5th June 1930.

The weevil, *Peritelus sphaeroides*, Germ., is recorded from the Rhône Valley as a pest of young fruit trees. The larvae do little damage, but the adults, which remain hidden by day at the foot of the trees, attack the young shoots at night, causing the death of nursery stock, and considerably reducing the crop of older trees. Control is difficult, but the trees should be treated with an arsenical from the time of blossoming.

BÖRNER (C.). **Die Verbreitung der Reblaus in Deutschland nach dem Stande des Jahres 1929.** [The Distribution of *Phylloxera* in Germany as shown by the Position in 1929.]—*NachrBl. deuts. PflSchDienst,* x, no. 6, pp. 41–43. Berlin, June 1930.

In 1929 the vineyards destroyed owing to infestation by *Phylloxera* covered an area slightly smaller than the average for the preceding five years. Re-planting with grafted vines is proceeding.

VOELKEL (H.). **Vorläufige Mitteilung über den gesetzmässigen Ablauf der Massenvermehrung von Insekten.** [Preliminary Communication on the Laws governing the Course of Outbreaks of Insects.]—*NachrBl. deuts. PflSchDienst,* x, no. 6, p. 44. Berlin, June 1930.

Observations on the pine moth [*Bupalus piniarius*, L.] in various parts of Germany showed that before an outbreak the size and weight of the pupae, the length of the egg-tubes of the adults and the number of deposited and viable eggs increase in each successive generation until the peak is reached, after which there is a gradual decrease from generation to generation. If an injurious factor acts on a developmental stage (for instance, the ingestion of arsenic by the larvae) after the peak has been reached, the rate of decrease is accelerated in all subsequent generations. This explains the smaller size and weight of pupae from dusted areas. The same effect can be obtained in the laboratory in various ways. These results apply also to other forest Lepidoptera and sawflies.

SEIFF (W.). **Einiges über den gebänderten Kiefernspanner** *Ellopia prosapiaria* **L.** [Some Notes on the banded Pine Moth, *E. prosapiaria*.]—*Anz. Schädlingsk.,* vi, no. 5, pp. 49–52, 6 figs. Berlin, 15th May 1930.

The banded pine moth, *Ellopia prosapiaria*, L., has occasionally been observed among the vast numbers of the ordinary pine moth, *Bupalus piniarius*, L., that have occurred in recent years in Germany. In the first instar, larvae bred from eggs of the second generation in August 1929 fed on the surface of the needles, but after moulting they attacked

them in the same manner as those of *B. piniarius*. The first cocoon was spun on the ground of the cage on 3rd February 1930, and pupation began on 11th February.

RAUM (O. F.). **Heuschreckenplage in Ostafrika und ihre Bekämpfung.** [The Locust Pest in East Africa and its Control.]—*Anz. Schädlingsk.*, vi, no. 5, pp. 52–58. Berlin, 15th May 1930.

The first swarms of *Schistocerca gregaria*, Forsk., which appeared in the Kilimanjaro region at the end of January 1929, consisted of freshly moulted bluish pink adults. Some swarms were observed to fly over a peak 16,400 ft. high. The main direction of flight was south-westward into Tanganyika. The locusts acquired the yellow colouration and began ovipositing in two months; eggs hatched in 8–14 days. Many crops were damaged, the locusts preferring orange, banana and European fruit trees and being specially attracted by a native species of *Solanum*. *Eucalyptus*, *Anona*, *Cinchona*, mango, lemon, lime and tangerine were avoided.

Marabout storks and kites destroyed numbers of the locusts, and in some localities up to 60 per cent. of the eggs were infested by Dipterous larvae, which were also found in the adults. Control measures are briefly reviewed, poisoned baits being recommended.

v. BUTOVITSCH [V.]. **Einige Bemerkungen über die an Weymouthskiefern vorkommenden Schädlinge.** [Some Observations on the Pests occurring on Weymouth Pine.]—*Silva*, 1930, pp. 51–54. (Abstract in *Anz. Schädlingsk.*, vi, no. 5, pp. 58–59. Berlin, 15th May 1930.)

In recent years 25-year-old Weymouth pines [*Pinus strobus*] in dense woods at Woidnig, Prussia, have suffered considerably from insects and fungi. Insects found in stem-sections were *Cydia* (*Laspeyresia*) *coniferana*, Ratz., *Dioryctria splendidella*, H.S., *Myelophilus piniperda*, L., *Pissodes pini*, L., and *P. piniphilus*, Hbst. Larvae of *Hylobius abietis*, L., occurred in standing timber, an unusual breeding-place, and *Ips* (*Pityogenes*) *bidentatus*, Hbst., and *Pogonochaerus fasciculatus*, DeG., in dead stems. The species of *Pissodes* are more or less primary pests ; repeated infestation weakens the trees and renders them susceptible to attacks of other insects.

ECKSTEIN [K.]. **Der Birkenspanner** (*Amphidasis betularius*). [The Birch Geometrid.]—*Anz. Schädlingsk.*, vi, no. 5, pp. 59–60, 1 fig. Berlin, 15th May 1930.

Amphidasys betularia, L., is recorded as defoliating larches 3 ft. high in a nursery in Germany, only one larva occurring on each plant.

HERING (M.). **Eine Minierfliege als Schädling an Erbsenpflanzen.** [A mining Fly as a Pest of Pea Plants.]—*Anz. Schädlingsk.*, vi, no. 6, pp. 61–64, 6 figs., 2 refs. Berlin, 15th June 1930.

The Agromyzid, *Agromyza lathyri*, Hend., is recorded as mining the leaves of peas (*Pisum sativum*) in Germany ; it had previously been known only from *Lathyrus* spp. Descriptions are given of the larva, adult and mine, which is compared with those of other pea leaf-miners.

Stellwaag (F.). **Giftigkeit und Giftwert der Insektizide. III. Teil: Allgemeine Technik der physiologischen Wertbestimmung (Schluss).** [Toxicity and toxic Value of Insecticides. Part III. The general Technique of Determination of physiological Value (Conclusion).]—*Anz. Schädlingsk.*, vi, no. 6, pp. 64–68, 1 fig., 4 refs. Berlin, 15th June 1930.

In this further discussion of the physiological determination of insecticidal values by laboratory experiments [*R.A.E.*, A, xviii, 433], it is pointed out that attention should be paid to external factors, such as temperature and light. Larvae of *Bombyx mori*, L., died in 90–140 minutes at 12° C. [53·6° F.], and in 7–13 minutes at 32° C. [89·6° F.], when kept in glasses containing filter paper moistened with 0·0004 per cent. pure nicotine. The insects most suitable for experimental work are discussed, and methods of determining the times at which activity ceases and death occurs are described. In experiments on the effectiveness of insecticides or the susceptibility of insects, a standard preparation or insect should be used for comparison. Batches of from 30 to 100 insects should be employed, and the tests should be repeated two or three times, control insects being kept both with and without food.

Galli-Valerio (B.). **Beschädigung von Wohnungen durch Heimchen (*Gryllus domesticus* L.).** [Injury in Dwellings caused by Crickets.]—*Anz. Schädlingsk.*, vi, no. 6, pp. 69–70. Berlin, 15th June 1930.

In the summer of 1929 houses in a quarter of Lausanne were invaded by large numbers of *Gryllus domesticus*, L., and considerable damage was caused to foodstuffs, etc. The crickets were breeding in a refuse dump in the vicinity. Watering with a 25–30 per cent. solution of calcium chloride appeared to have effected control, as up to the time of writing (March 1930) no further outbreak had occurred.

Bako (G.). **The Orange Fly, a new Pest of our Orchards.** [*In Magyar.*] —*Növenynéd*, 1928, pp. 210–214. Budapest, 1928. (Abstract in *Neuheiten PflSchutzes*, 1930, no. 1, p. 13. Vienna, 1930.)

Ceratitis capitata, Wied., has been observed infesting peaches in Hungary, having been introduced in fruit from the Mediterranean region.

Seitschek (F.). *Hylobius abietis*, **schädlicher Larvenfrass.** [Injurious Feeding by the Larvae of *H. abietis*.]—*Zbl. ges. Forstwesen*, lv, pp. 242–244, 2 figs. Vienna, 1929. (Abstract in *Neuheiten PflSchutzes*, 1930, no. 1, pp. 16–17. Vienna, 1930.)

The larvae of *Hylobius abietis*, L., are recorded as feeding on the roots of pines at least 7 years old near Vienna. The rings made were 1·6–2·4 ins. wide, being situated partly above and partly below ground. The adults fed on the shoots of the trees. Trees killed by the larvae were infested by *Ips* (*Pityogenes*) *bidentatus*, Hbst.

Zpráva o škodlivých Činitelích kulturních Rostlin v Republice Československé v Roce 1929. [Report on adverse Factors affecting cultivated Plants in the Republic of Czechoslovakia in the Year 1929.]—*Ochrana Rostlin*, x, pt. 1–2, pp. 1–55, 10 figs. Prague, 1930.

This report includes papers by various authors on the diseases and pests of cultivated plants observed in Czechoslovakia in 1929, arranged under the crops attacked and showing the date and locality of each infestation.

Petri (L.). **Rassegna dei casi fitopatologici osservati nel 1929.** [A Review of phytopathological Cases observed in 1929.]—*Boll. R. Staz. Pat. veg.*, x, N.S., no. 1, pp. 1–43. Rome, 1930.

The bulk of this report concerns fungous pests. The insects recorded from various parts of Italy include *Capnodis tenebrionis*, L., on peach; *Leucaspis pusilla*, Lw., and *Thaumetopoea pityocampa*, Schiff., on pine; *Porthetria* (*Lymantria*) *dispar*, L., on oak; *Agrilus viridis*, L., on beech; *Oscinella* (*Oscinis*) *frit*, L., and *Cephus pygmaeus*, L., on wheat; and *Cirphis* (*Leucania*) *zeae*, Dup., in stored maize.

[Petrov (A. I.).] **Петров (А. И.). Short Manual for the Collection of Information on Pests of cultivated Plants and their Control.** [*In Russian.*]—Med. 8vo, 266 pp., 100 figs. Vladimir-na-Klyaz'me, 1927. Price 1 *r.* 75 *kop.* [Recd. 1930.]

This popular handbook contains notes on the bionomics and control of the chief insect pests and fungi that attack cultivated crops in the Government of Vladimir (central Russia) and on the use of insecticides. Each pest is briefly described, but only the popular names are given. A key to the chief pests in the stage in which they attack the plant, based partly on the injury caused, and notes on the collection and transport of specimens are included, one of the chief objects of the book being to obtain information from the growers concerning the incidence of the various pests.

[Stark (N.).] **Старк (Н.). The Enemies of the Forest.** [*In Russian.*]—Large Cr. 8vo, 288 pp., 104 figs. Moscow, Gosud. Izd., 1929. Price 2 *r.* 25 *kop.* [Recd. 1930.]

This book is intended for forest officers and schools of forestry, and gives a popular account of the bionomics and control of a number of insects infesting coniferous, deciduous and mixed forests in Russia, the pests being arranged in each case according to the part of the tree attacked.

[Kharin (S.).] **Харин (С.).** *Caradrina exigua* **and its Appearance in large Numbers on the Seed Farm at Bairam-Ali in 1929.** [*In Russian.*]—*Khlopkovoe Delo*, 1929, no. 10, reprint 7 pp., 6 figs. Tashkent, Glavn.khlopkov.Komit., 1929. [Recd. 1930.]

A severe local infestation of cotton seedlings by *Laphygma* (*Caradrina*) *exigua*, Hb., in Uzbekistan was controlled by flooding the field, which destroyed all the larvae and stimulated the growth of the plants,

most of which recovered from the injury caused. Weeds growing in an infested cotton field should not be destroyed until after the application of some control measure, as otherwise the larvae will concentrate on the cotton. In another infested field, the larvae were destroyed by sprays of 1 lb. Paris green, 2 lb. lime and 100 gals. water.

[Beĭ-Bienko (G.).] **Бей-Биенко (Г.). Contribution to the Study of the Pests of Sugar-Beet of the Aleisk District, Barnaul Region.** [*In Russian.*]—*Trud. sib. Inst. sel. Khoz. Lesovod.*, xiii, no. 1, pp. 193–200, 6 refs. Omsk, 1929. (With a Summary in English.) [Recd. 1930.]

Notes are given on 24 insect pests observed on sugar-beet in the Province of Barnaul (western Siberia) in July 1929, few of which were numerous enough to cause appreciable damage. Among the more important were the Capsid, *Poeciloscytus cognatus*, Fieb., *Chaetocnema concinna*, Mshm., which was also common on *Polygonum convolvulus* and *Rumex* sp., *Psylliodes cupreata*, Duft., *Tanymecus palliatus*, F., and *Loxostege sticticalis*, L. *Bothynoderes foveicollis*, Gebl., caused severe damage in many localities and constituted 80–85 per cent. of all the weevils found on beet. It has previously been recorded from the Kamen district [*R.A.E.*, A, xviii, 53], where it is of minor importance. Very little is known of its bionomics; the larvae, like those of *B. punctiventris*, Germ., feed on the roots, causing the plants to wither. Another weevil, *Thylacites pilosus*, F., which was observed for the first time on beet, attacked the leaves, but the damage caused was negligible.

Anderson (T. J.). **Control of Maize Stalk Borers.**—*Pan-Afr. Agric. Vet. Conf., Pretoria, 1929,* Papers Agric. Sect., pp. 238–242. Pretoria, Un. S. Afr. Dept. Agric., 1929. [Recd. 1930.]

Maize Insects and Diseases.—*Idem*, Rep. Proc., pp. 94–101.

The first paper, dealing with *Busseola fusca*, Fuller, and *Sesamia calamistis*, Hmps., in Kenya, has already been noticed [*R.A.E.*, A, xvii, 693]. The second includes a brief review by T. J. Naudé of the measures employed in South Africa against maize pests, particularly *B. fusca*. In the Transvaal, maize seedlings are attacked by weevils of the genus *Protostrophus*, against which baits of sodium arsenite have given fairly satisfactory control. A. Ledreux stated that in Madagascar very important damage to maize is caused by *Heteronychus* [*plebeius*, Klug], and the growing of this crop had to be abandoned in the northern part of the Island. This Dynastid also attacks sugar-cane and young cacao [*cf.*, xviii, 103, etc.]. Naudé added that several species of *Heteronychus* occur as occasional pests in South Africa [*cf.* xii, 264].

Naudé (T. J.). **Insect Pests of Cotton and Tobacco in South Africa.**—*Pan-Afr. Agric. Vet. Conf., Pretoria, 1929,* Papers Agric. Sect., pp. 255–256. Pretoria, Un. S. Afr. Dept. Agric., 1929.

Cotton Diseases and Pests. Tobacco Diseases and Pests.—*Idem*, Rep. Proc., pp. 80–87 & 87–92.

The cotton pests recorded from South Africa are *Diparopsis castanea*, Hmps., which has a number of wild food-plants, this accounting largely

for its wide distribution and the difficulty of its control ; *Heliothis* (*Chloridea*) *obsoleta*, F., which has five generations a year and does not hibernate in the warmer areas, such as the north-eastern Transvaal ; the spiny bollworms, *Earias insulana*, Boisd., *E. biplaga*, Wlk., and *E. cupreoviridis*, Wlk., which cause relatively insignificant damage ; the Jassid, *Empoasca facialis*, Jac., which is a serious pest in the more humid areas, particularly in wet seasons, and is also abundant on peas, cowpeas, and ground-nuts ; *Dysdercus fasciatus*, Sign., and *D. nigrofasciatus*, Stål, which are associated with boll-rots, but are only occasionally of importance ; and *Oxycarenus albidipennis*, Stål, which is very common but does not cause extensive injury. Of the soil pests, considerable damage is occasionally done by cutworms, *Dasus* (*Gonocephalum*) *simplex*, F., weevils of the genera *Protostrophus* and *Strophosomus*, and the Eumolpids, *Syagrus rugifrons*, Baly, and *S. puncticollis*, Lef. The tobacco pests are *Lema bilineata*, Germ., which usually appears in the seedbeds from August onwards, severe infestation following late in the season as a result of prolonged local breeding; *Phthorimaea operculella*, Zell., which causes serious damage to seedlings in spring, and later to plants in the field by mining the leaves ; and *H. obsoleta*, which occasionally infests tobacco grown for seed. Very brief notes are given on the measures used against many of these pests.

In the discussion that followed a number of speakers referred to the conditions regarding cotton pests in other countries. W. Nowell agreed with the view that the prevalence of *Dysdercus* spp. and the boll-rots they transmit is the most important factor limiting cotton cultivation in tropical countries. In St. Vincent the eradication of the alternative food-plants of the stainers, such as *Eriodendron* and *Malachra*, is an effective control measure ; this, however, should be accompanied by proper disposal of cotton seed, as outbreaks have been traced to the use of cotton seed as manure and to seed left in ginneries. R. Jack said that no serious outbreaks of *Diparopsis castanea* occur in Southern Rhodesia, although it is very injurious in other parts of southern Africa.

SEYDEL (C.). **The Pink Cotton Bollworm** (*Gelechia gossypiella*) **in Belgian Congo.**—*Pan-Afr. Agric. Vet. Conf., Pretoria, 1929*, Papers Agric. Sect., pp. 257–258. Pretoria, Un. S. Afr. Dept. Agric., 1929.

The inefficiency of the measures used in the Belgian Congo to prevent the introduction or spread of *Platyedra* (*Gelechia*) *gossypiella*, Saund. (pink bollworm) is pointed out [*cf. R.A.E.*, A, xvi, 303, 535 ; xviii, 260]. Disinfection of seed by heat is unsatisfactory if entrusted to native labour, and the possibibility of treating it by fumigation or by immersion in insecticides that would not affect germination should be considered.

JAMES (H. C.). **Biological Control in Kenya Colony with special Reference to the Problem of the common Coffee Mealybug,** *Pseudococcus lilacinus*, **Ckll.**—*Pan-Afr. Agric. Vet. Conf., Pretoria, 1929*, Papers Agric. Sect., pp. 259–263. Pretoria, Un. S. Afr. Dept. Agric., 1929.

Biological Control as a Method of combating introduced and native Insect Pests in Africa.—*Idem*, Rep. Proc., pp. 103–105.

The paper by James has been noticed from another source [*R.A.E.*, A, xvii, 693].

In the discussion T. J. Naudé pointed out the desirability of co-ordinating work on biological control in all countries interested in a given project. He gave a list of pests that are common to two or more territories in Africa, to indicate a basis of common interest and possible co-operation. Referring to the biological control of *Pseudococcus lilacinus*, Ckll. (coffee mealybug) in Kenya, J. McDonald gave a brief review of the control of the ant, *Pheidole punctulata*, Mayr, which limits the activities of the Coccinellids that attack the mealybug [xvi, 310]. The latter apparently increases much more quickly than its natural enemies, especially in the early part of the season, and does considerable damage before the predators become active. Reserve supplies of indigenous Coccinellids are therefore bred in Kenya for release in the early stages of infestation, and planters are being encouraged to breed them for themselves and to collect them from other plants on which mealybugs occur.

Williams (R. H.). **The Migratory Locust Problem in Africa. Advisability of joint Action.** —*Pan-Afr. Agric. Vet. Conf., Pretoria, 1929*, Papers Agric. Sect., pp. 263–264. Pretoria, Un. S. Afr. Dept. Agric., 1929.

The Locust Problem.—*Idem*, Rep. Proc., pp. 108–113, 274.

The desirability of forming a Pan-African Locust Bureau, in order to obtain maximum efficiency in locust control, is urged. Its functions would be to receive, record and co-ordinate information on various aspects of the locust problem, draw up proposals for combined action, and undertake propaganda work in connection with locust campaigns. The organisation should be maintained for at least five years, and its work should be carried out under the control of a Committee composed of delegates from each Territory sharing in its cost.

In the discussion, G. N. Williams said that the proposed Bureau must avoid interference with administrative and executive work, and must not be concerned with propaganda. He proposed a resolution expressing the desirability of discussing closer co-ordination of control measures by various Territories of Africa, and of establishing an Information Bureau for that purpose, and suggesting that the Government of South Africa undertake the initiative of approaching the countries concerned. This motion was carried unanimously.

D. L. Blunt stated that during the 1928 invasion of *Schistocerca gregaria*, Forsk., in Kenya, a vast majority of the hoppers matured in the uninhabited areas, and the flying swarms so formed invaded the cultivated regions. He stressed the uselessness of control measures that do not embrace the whole area liable to be affected.

Potgieter (J. T.). **A Contribution to the Biology of the Brown Swarm Locust** *Locustana pardalina* **(Wlk.) and its natural Enemies.**—*Pan-Afr. Agric. Vet. Conf., Pretoria, 1929*, Papers Agric. Sect., pp. 265–308, 1 map, 7 pls., 8 refs. Pretoria, Un. S. Afr. Dept. Agric., 1929.

The Biology of the Brown Swarm Locust.—*Idem*, Rep. Proc., pp. 113–127.

The annual expenditure by the Government of South Africa on *Locustana pardalina*, Wlk., during 1920–29, which reached a total

for the nine years of £1,183,446, is tabulated, and the history of locust research in that country is discussed. The two injurious species of migratory locusts in South Africa are *Nomadacris septemfasciata*, Serv. (red locust), which usually occurs in the east, and *L. pardalina*, which is more prevalent in the west.

An account is given of the results obtained by the author in experiments on various aspects of the biology of *L. pardalina*. It was found that temperature is the main factor determining the duration of the hopper stages. The results obtained from various crosses between brown, green and grey individuals are discussed in great detail. Various colour forms present under natural conditions also appeared in hoppers experimented upon, and these forms were not affected by temperature, light, food or colour of the soil, or by the hoppers being kept singly or together in a cage. The author advances the hypothesis that the colour differences are Mendelian in character, and as he also failed to find morphological differences, he is inclined to dispute the validity of Uvarov's theory of phases.

In the initial stages of the building up of a swarm from scattered individuals, which may be a remnant of a swarm of fliers or result from eggs of which the majority have not hatched, the progeny consists of a majority of brown, with a fair number of grey and green individuals. The increase in the numbers of locusts is accompanied by an increase in the relative number of brown individuals, owing to a lethal factor often observed in crosses between grey and green locusts, and the small chance of these latter mating with the more numerous brown individuals, in which case the mating results in a majority of brown offspring.

The idea of temporary and permanent breeding grounds as ascribed to *L. pardalina* is untenable, for typical solitary fliers have been found under conditions differing from those that are commonly supposed to characterise the permanent breeding grounds. The whole area in which this locust has bred in the past should be considered as one large natural breeding ground, extending into southern Angola, and perhaps including north-western Rhodesia.

From a study of locust reports for the last 40 years the author finds that *Locustana* has been continually present in some locality or other of southern Africa; he concludes, therefore, that no definite locust cycles exist. Migrations are due to the intensification of the migratory instinct owing to the presence of a large number of individuals.

Valuable assistance in locust destruction is rendered by various migratory birds, including storks (*Ciconia* and *Abdimia*), the small locust bird (*Glareola melanoptera*), a kestrel (*Tinnunculus naumanni*), and a kite (*Milvus aegyptius*). Of the South African birds, the wattled starling (*Creatophora carunculatus*) destroys the hoppers, and two species of *Tinnunculus* often follow flying swarms in great numbers. Pheasants and guineafowl destroy the hoppers and eggs, and veldt rodents and baboons readily feed on the latter. In March and April 1925 large numbers of locusts were destroyed by a fungus, *Empusa grylli*.

An account is given of some observations and experiments on the biology of four Dipterous parasites of this locust, *viz.*, the Nemestrinid, *Symmictus costatus*, Lw., the Bombyliid, *Systoechus albidus*, Lw., the Muscid, *Stomatorrhina lunata*, F., and the Calliphorid, *Wohlfahrtia euvittata*, Villen. The larva of *Symmictus* occurs within the body of the locust, but though it may possibly shorten its life, it does not prevent

it from ovipositing. The other three species infest the egg-pods, and *Wohlfahrtia* the other stages as well. Their distribution and the percentage of egg-pods they destroy are indicated in a table. The author succeeded in breeding *Wohlfahrtia* on meat.

In the discussion J. C. Faure said that it was impossible to deny the existence of temporary and permanent breeding areas of *L. pardalina*, for recent locust history in South Africa shows that it has always reappeared in areas regarded as natural breeding grounds. The fact that solitary individuals were found in localities considered unsuitable as breeding grounds was due to observations being made shortly after swarms had been present. Three types of breeding grounds for this locust should be distinguished, *viz.*, temporary swarm breeding grounds, which are overrun from time to time ; the permanent area where the solitary locusts maintain themselves continuously ; and the smaller transformation areas, found in the permanent area, in which swarms are built up. He did not consider the arguments advanced to disprove Uvarov's theory of phases to be convincing, the failure to find sufficiently pronounced morphological characters separating the two phases merely showing that transitional types were being dealt with. The idea that the differences of colour in locusts are caused by Mendelian factors is based on insufficient data. With reference to the statement that crosses between non-brown individuals could never produce brown offspring, the speaker described his experiments, in which brown gregarious individuals were obtained by crowding from green and grey solitary ones [*R.A.E.*, A, xi, 508].

C. P. Lounsbury confirmed the statement that since the early nineties swarms of locusts have always been present in one locality or another in South Africa. Very little is known of the breeding grounds of *Nomadacris septemfasciata*, but *L. pardalina* appears to be much more definitely a South African species. From experience gained from former invasions of this locust, it appears that swarms commonly arise by a rapid breeding and gathering together of solitary forms ; this process is associated with the favourable years that follow a period of drought.

C. K. Brain was not prepared to express an opinion on the theory that a lethal factor and lessened vitality result from crosses of certain forms of *L. pardalina*, but suggested that certain strains may mature quicker than others.

T. J. Naudé expressed his conviction of the existence of restricted breeding grounds, as there is a distinct similarity between different localities in which the solitary phase locusts have been found, and mentioned cases of transformation of the brown form into the solitary one under natural conditions.

Jack (R. W.). **Report of the Chief Entomologist for the Year ending 31st December 1929.**—*Rep. Secy. Dept. Agric. S. Rhodesia 1929*, pp. 45–52. Salisbury, 1930.

An account is given of the work carried out on agricultural pests, several of which were recorded in the previous year's report [*R.A.E.*, A, xvii, 605]. Experiments undertaken with a view to discovering the insect vector, if any, of tobacco mosaic disease gave negative results with the Capsid, *Engytatus volucer*, Kirk., and the Aphid, *Myzus persicae*, Sulz. The disease known as "crinkle" was, however,

transmitted by *E. volucer*. Maize planted early as a trap crop for *Busseola* (*Glottula*) *fusca*, Fuller (maize stalk borer) was 100 per cent. infested, though the infestation of the main crop was negligible.

Ephestia elutella, Hb., was reported as attacking Rhodesian tobacco stored in warehouses in London. With a view to determining whether the infestation had been contracted in Rhodesia, a thorough examination of tobacco stored in warehouses, barns, etc., in and around Salisbury was carried out, with completely negative results. Moreover, inspection of transit sheds and wharves at Beira, Portuguese East Africa, of tobacco in transit, and of a tobacco and cigarette factory in the vicinity, gave no indications of any potential source of infestation.

Cherian (M. C.). **Life-history Notes on** *Microbracon serinopae*, **Ramrkr. (MS.).—A Parasite on** *Nephantis serinopa*.—*Yearb. Dept. Agric. Madras 1928*, pp. 12–22, 1 pl. Madras, 1929. [Recd. 1930.]

During August 1927 the Braconid, *Microbracon serinopae*, sp. n., a parasite of *Nephantis serinopa*, Meyr. (coconut caterpillar), was collected in Cochin and adjoining British territory, and as it was found possible to rear it in large numbers in the insectary at Coimbatore, it was subsequently distributed to breeding stations at Calicut, Mangalore and Ponnani, and later liberated in infested plantations on the west coast of Madras [*R.A.E.*, A, xviii, 193].

All stages are briefly described. Observations on the bionomics were made in the insectary. Pairing usually takes place on the day of emergence, and oviposition begins a day or so later. After stinging the host caterpillar, the female deposits 8–12 eggs, usually on the ventral surface. The maximum number of eggs laid by a single female was 440 in 55 days. The egg stage lasts a little more than a day, the larval stage 3–4 days and the pupal stage 2–4. The mature larvae spin cocoons of white silk by the side of the dead caterpillar. Parthenogenetic reproduction has been observed in this species. The adults seem to prefer to feed on the body juices of the host caterpillars, but if these are not present they will feed on jaggery water. In longevity experiments, the maximum length of life was 38 days for males and 66 for females. Adults without food lived only 2–4 days. *M. serinopae* was not found parasitising any other host in nature. In the insectary, larvae of *N. serinopa* were preferred and although eggs were laid on larvae of *Argyria fuscivenalis*, Hmps., *Utetheisa pulchella*, L., a Noctuid on cotton, *Prodenia litura*, F., *Marasmia trapezalis*, Gn., *Earias* sp., and *Parnara mathias*, F., adult parasites were only obtained from the first three hosts, the larvae dying on the others. The author has not observed any hyperparasites of *M. serinopae*, but a species of *Pleurotropis* was bred from its cocoons in Cochin in 1925.

A comparison of the life-history of the Braconid with those of the two other larval parasites of *N. serinopa*, *Elasmus nephantidis*, Rohw., and *Perisierola* sp. [xvii, 113], shows that the total life-cycle is shorter, the longevity of the adults is greater and the egg-laying capacity higher in the case of *M. serinopae* than in the other two.

Andrews (E. A.). **The Tea Seed Bug** (*Poecilocoris latus* **Dall.**).—*Quart. J. Ind. Tea Ass.*, 1930, pt. 1, pp. 15–27. Calcutta, 1930.

Preliminary observations of the life-history of the Pentatomid, *Poecilocoris latus*, Dall. (tea seed bug) in Assam indicate that the

number of generations occurring annually varies from 3 to 4, there being much overlapping. The eggs are laid in clusters of 10–16 on either surface of the leaves, somewhat nearer to the apex than the base, where the curl affords shelter for them ; on one occasion they were found on the seed capsule. The first eggs are usually deposited 3–5 days after mating, but oviposition has been observed on the first or, in October, on the twelfth day. The largest number of clusters deposited by a single female is 3, and the largest number of eggs 37. Oviposition is completed in a few days, and the female dies soon afterwards. The eggs hatch in 4–9 days, differences of 2–3 days being not uncommon in the date of hatching of eggs of the same cluster. The adult stage is reached in 19–40 days after hatching, and mating has been observed 6 days later.

Although the juice of young tea-seeds is preferred, the bugs will also suck the flower-buds and stems, and have been reared in the laboratory entirely on flower-buds or even on leafy shoots. Thus injury may be caused in three ways : by attack on the flower-buds, which prevents the setting of seed ; by attack on the seed in its early stages, which prevents it from attaining maturity ; and in the later stages, which may produce the characteristic starred appearance and permit of the entrance of fungi. Cotyledons may form in seed that has been punctured without themselves being punctured, and it is only when the insect pierces the body of the cotyledon that any effect will be visible unless a fungus enters through the puncture. The various methods by which it might be possible for the fungus to enter the seed are discussed.

The so-called " starred " seed is that which has been sucked at a comparatively late stage. This starred appearance has been found to be due to the formation of starch in the seed, which does not, however, occur at the same stage of development of the seed in every case, so that in some cases attack at a late stage may not be followed by starring. The damage does not extend beyond the starred area ; nor is food material stored up in the seed in the form of starch removed. Moreover, since the seed is so situated in the capsule that the germ is unlikely to be punctured, it is improbable that germination will be prevented by punctures in well-formed seed.

An account is given of an attempt to control *P. latus* by machine dusting with calcium cyanide. The machines were fitted with long flexible nozzles, which could be raised gradually up the tree. The operators moved backward in line against the wind, which carried the dust over the whole area in a uniform cloud. The results were irregular and unsatisfactory, but a decrease of 30 per cent. of starred seed was secured by two applications, one on 15th July and the other on 3rd September. It was found that $\frac{2}{3}$ oz. to a bush was required for satisfactory dusting, so that the cost per acre of each application would be £2 2*s*. for material alone, whereas the maximum benefit that might be obtained by reduction in injury is estimated at £2 14*s*. an acre.

Notification, no. 1343—Agric.—*Govt. India, Dept. Educ., Health & Lds.* 1 p. typescript. Simla, 21st June 1930.

The importation into the Madras Presidency of unroasted coffee beans originating outside India is prohibited from 8th August 1930.

McCarthy (T.). **The Bathurst Burr Seed Fly** (*Camaromyia bullans*, **Wied.**).—*Agric. Gaz. N.S.W.*, xli, pt. 5, pp. 379–381, 10 figs. Sydney, 1st May 1930.

Camaromyia bullans, Wied., which has not previously been recorded in Australia, was found infesting the seeds of *Xanthium spinosum* (Bathurst burr), a troublesome weed, in several widely scattered localities in New South Wales. This Trypetid occurs in southern Europe and South America, and was probably originally introduced with the food-plant from Chile. In most cases only one seed in the burr was infested, but the other was usually badly developed and shrivelled.

Meyrick (E.). **Exotic Microlepidoptera, iii, pt. 19.**—pp. 577–608. Marlborough, Wilts, the author, August 1930. Price, 3*s*. per part.

Among the species dealt with are the Tortricids, *Argyroploce atmochlora*, sp. n., and *A. herbifera*, Meyr., rolling the leaves of camphor (*Cinnamomum camphora*) in Java, and *Eucosma cremastropis*, sp. n., bred in Uganda from seeds of *Podocarpus* imported from South Africa; and the Tineids, *Acrocercops serriformis*, sp. n., on castor oil plant (*Ricinus communis*) in Java, and *A. astaurota*, Meyr., mining the bark of pear (*Pyrus communis*) in Japan. The last-named pupates in the mines and is said to do considerable damage at times.

Chue (C. C.). **Some biological Notes on a Leaf-feeding Coccinellid** (*Epilachna 28-punctata* **Fabr.**).—*Lingnan Sci. J.*, vi, no. 4, pp. 301–313, 11 figs., 10 refs. Canton, 30th April 1930.

Notes are given on the bionomics of *Epilachna vigintioctopunctata*, F., in Kwangtung Province, where it attacks solanaceous plants. All stages are described, and the food-plants and habits of this and other species of *Epilachna* in various parts of the world are briefly discussed from the literature.

The rearing work and observations were carried out during July and August 1926, the average humidity being 80 per cent. and the maximum and minimum air temperatures 36·1° C. [97° F.] and 22·8° C. [73° F.]. The number of eggs deposited at a time varied from 3 to 78, the average in 18 batches being 34. One female kept for a period of 31 days laid 21 batches with a total of 744 eggs. The egg, larval and pupal stages last 4, 11–15 and 4 days respectively. Feeding begins about 24 hours after hatching, the plants most severely attacked being black nightshade (*Solanum nigrum*) and egg-plant (*S. melongena*). The leaves of tomato are also attacked, and although the beetle has not been found feeding on cucumber in the field, it is accepted to a limited extent if no other food is given. It was found that neither larvae nor adults would feed on papaya (*Carica payaya*), *Vigna* sp., *Phaseolus lunatus*, *Cajanus indicus*, plum or pepper (*Capsicum*). Both adults and larvae will feed on eggs of their own species, but the adults will not feed on the larvae. This Coccinellid is widely distributed and occurs in large numbers, probably owing to the shortness of the life-cycle, which permits of several generations a year. Overwintering adults appear about the middle of April and oviposit. The adults of the first generation appear within 17 days and oviposit after about 9 days. The beetles laid eggs in the laboratory for at least a month.

Chen (H. T.). **Notes on a Bamboo Borer** (*Cyrtotrachelus longimanus* **F.**).—*Lingnan Sci. J.*, vi, no. 4, pp. 353–366, 5 figs. Canton, 30th April 1930.

Cyrtotrachelus longimanus, F., all stages of which are described, is one of the most destructive insects attacking bamboo in the vicinity of Canton. The larvae of this weevil tunnel and feed in the young shoots; these fall to the ground at the time when the beetles are ready to enter the soil for pupation, involving the loss of the whole shoot.

Attempts to rear the larvae in the laboratory on cut bamboo shoots placed in water were usually unsuccessful. A more satisfactory method carried on in the field consisted of making longitudinal and radial incisions through the shoot, inserting the larva in a groove made in the soft tissue and tying up the shoot. Observations were made twice a day by untying the string and following the progress of the larva by lengthening the incision. Although one bamboo is probably adequate in nature for the development of one larva, it was in no case found sufficient in these studies, the young shoots growing more slowly than the larvae fed and the old ones being too tough to be more than partly edible. As the larva approached maturity, a cloth covering was applied to catch it as it fell from the exit hole. It was then placed in a glass jar on soil, which was kept moist. Eggs for rearing were kept on bamboo shoots, the bases of which were placed in water, and the larvae were transferred to the field on hatching. Eggs were found deposited near the top of the bamboo shoots in laboratory cages two days after mating pairs of adults had been placed in them, 1–3 eggs being found to a shoot either in individual punctures or together. All adults brought in from the field died in 2–3 weeks. The larva hatches in 2–3 days and at once becomes active, usually burrowing downwards. The larval stage lasts 14–17 days, and the pre-pupal and pupal stages in the soil each occupy 12. Hibernation occurs in the adult stage in the pupal cell, and may begin at least as early as 3rd July. The adults feed on the tender tissue of the bamboo plant, piercing the young shoots within a few inches of the top. Oviposition has been observed from the end of May till the latter part of July, and mating took place in the field as late as 5th August.

Control measures suggested include the destruction of the eggs in the young shoots by hand, cultivation of the soil to a depth of 1 ft. to kill all hibernating adults, and destruction of the adults, which are particularly easy to capture with a net.

Hôzawa (S.). **Observations on the Rice-weevil,** *Calandra oryzae*.—*Annot. zool. jap.*, xii, no. 1, pp. 25–37, 8 figs., 5 refs. Tokyo, 25th July 1929. [Recd. 1930.]

Notes are given on the life-history of *Calandra oryzae*, L., in Japan; all stages are described, and certain morphological peculiarities of the larva are discussed. The eggs are deposited, generally singly, within the kernel of rice and other grains, and hatch in 4–16 days according to the time of year. The author's observations indicate that there are 4 larval instars, instead of 3 as stated by others, the period required for each varying according to the season. The larval stage lasts 2 or 3 weeks, and the pre-pupal stage 1–2 days. The pupal period lasts 4–9

days, and the adult remains for 3–6 days within the kernel before emerging. The length of life varies greatly, and weevils that were not allowed to mate lived longer than others. One female that emerged from the kernel on 7th August 1919 lived till 10th March 1921.

DUSTAN (A. G.). **Control of the Onion Maggot and the Carrot Rust Fly.**—*25th Ann. Rep. Veg. Gr. Ass. Ontario, 1929*, pp. 47–52. Toronto, Ont., 1930.

Hylemyia antiqua, Mg. (onion maggot) is present almost every year in the great majority of the onion fields in the Ottawa district, particularly on light soil, where it destroys from 10 to 90 per cent. of the crop. It has one complete and two partial generations a year. The adults emerge during the last week in May and begin to oviposit about the time that the earliest varieties of apple come into bloom. The eggs hatch in about a week. When the seedlings are small they are quickly destroyed, one larva killing 6–8 plants before reaching maturity. The bulk of the injury is caused late in June or early in July. Of a number of control measures tested, spraying with an oil emulsion gave the best results. The oil used is a low grade lubricating oil having the following characters :—specific gravity at 60° F., 24–26 A.P.I. ; flash point (open cup), 360° F. (min.) ; viscosity at 100° F., 170–220 seconds ; volatility (loss at 105–110° C. after four hours), 0·41 per cent. One gallon of Bordeaux mixture (4–4–40) should be used for emulsifying 1 gal. of oil, and 2 gals. of the emulsion should be diluted with 40 gals. water. If the water is very hard, Bordeaux mixture should be used as a diluent to prevent the emulsion from breaking down. Since the spray acts as a repellent rather than an ovicide or larvicide, spraying should be begun as soon as the plants are $1\frac{1}{2}$ ins. high. Four applications at weekly intervals should be made, and the spray should be applied not only to the plants but also to the soil between the rows, at the rate of 125 gals. to the acre and at a pressure of at least 150 lb. The cost of material for four applications to the acre is estimated at about 18*s*., or 36*s*. if Bordeaux mixture is used as the diluent.

Psila rosae, F. (carrot rust fly) is a serious pest of carrots in certain localities in the Province, but is usually more injurious on small plots than under field conditions. It has two generations a year, hibernation occurring in the pupal stage at a depth of 2–3 ins. in the soil. Adults of the over-wintered generation are on the wing from the last week in May until the middle of June. Oviposition begins a few days after emergence, and the eggs hatch in 7–12 days. Adults of the next generation appear about the middle of August and are present until frosts occur. Injury by the larvae of the first generation can be prevented by postponing the sowing of carrots until adults of the overwintered generation have disappeared. If an earlier crop is required, watering with mercury bichloride (1 oz. to 10 gals. water) is recommended. Two applications, at the rate of 800 gals. to the acre, should be made at an interval of a week, the first soon after the flies begin to oviposit. The date on which the first eggs are laid coincides closely with the appearance of the first blossoms of choke-cherry (*Prunus virginiana*). Although this treatment is liable to check the growth of the plants for a time, they soon recover. The cost of two applications is estimated at £4 10*s*. an acre. In order to avoid injury to carrots late in the season, the crop should be harvested before the adults that give rise to the overwintering generation oviposit.

Caesar (L.). **Insects attacking Raspberries and Blackberries.**—*Bull. Ontario Dept. Agric.*, no. 355, pp. 26–31, 4 figs. Toronto, Ont., April 1930.

Brief notes are given on the bionomics and control of the chief pests of raspberries in Ontario, *viz.*, *Oecanthus nigricornis*, Wlk. (striped tree cricket), *Monophadnus* (*Monophadnoides*) *rubi*, Harr. (raspberry sawfly), *Tetranychus telarius*, L., *Agrilus ruficollis*, F. (red-necked cane borer), *Byturus unicolor*, Say (raspberry fruit worm), and *Oberea bimaculata*, Ol. (raspberry cane borer). *Metallus rubi*, Forbes (*bethunei*, MacG.) mines in the leaves of blackberry, and in some years considerably reduces the crop ; no satisfactory method of control is known.

Gilliatt (F. C.). **The Bionomics of the White Triangle Leaf-roller, *Cacoecia persicana* Fitch.**—*Sci. Agric.*, x, no. 10, pp. 631–653, 4 pls., 8 refs. Ottawa, Ont., June 1930.

A detailed account is given of studies on the life-history of *Tortrix* (*Cacoecia*) *persicana*, Fitch (white triangle leaf-roller), which is a minor pest in apple orchards of the Annapolis Valley, Nova Scotia [*cf. R.A.E.*, A, xvii, 91]. All stages are described. At the time the larvae emerge from their winter quarters, the available vegetation is limited, and they have been found feeding on grasses and numerous wild plants. It seems probable that any plants likely to grow beneath trees in an orchard are more or less readily eaten at this time, but that later they are largely deserted for apple foliage. Larvae of the new generation in summer are also found to a limited extent beneath the trees.

In 1927 and 1928 oviposition began between 15th and 20th June and reached its maximum during the last week in June and the first week in July. The minimum length of the egg stage was 9 days. The larvae appear about the beginning of July and continue to hatch for about 3 weeks. During the last half of September and October the half-grown larvae drop to the ground and hibernate in rolled leaves. In the spring they emerge about the beginning of May, feed for a short time on the surrounding vegetation, and then ascend the trees. In 1928 they reached maturity in 28–39 days. The maximum emergence of the adults occurred at the end of June. The adults are not active during the day and are only slightly attracted to light.

Whenever the webbed foliage, within which the larvae shelter, comes into contact with the fruit, injury, which is caused by shallow surface feeding, invariably follows, but feeding on the fruit appears to be largely a matter of chance, especially during the early larval period.

In Nova Scotia appreciable injury by *T. persicana* has always been associated with infestation by *Eucosma* (*Spilonota*) *ocellana*, Schiff. (eye-spotted budmoth). The newly hatched larvae of the former, which at first do not appear to be able to make shelters for themselves, use the shelters made by *E. ocellana*. When these are not available, most of them drop to the ground and many mature on the undergrowth. Thus it appears that as long as the present outbreak of *E. ocellana* continues and grass and weeds are allowed to grow beneath the trees, there is danger of *T. persicana* becoming a major pest in the Annapolis Valley.

Smith (L. M.). *Macrorileya oecanthi* **Ashm. A Hymenopterous Egg Parasite of Tree Crickets.**—*Univ. Calif. Pub. Ent.*, v, no. 8, pp. 165–172, 5 figs. Berkeley, Cal., 1930.

During investigations on *Oecanthus niveus*, DeG. (snowy tree cricket) carried out in California from 1927 to 1929, the eggs were found to be parasitised by the Eurytomid, *Macrorileya oecanthi*, Ashm. Laboratory observations were made on the parasite, using eggs of *O. niveus* in raspberry canes. Pairing and oviposition occur in sunlight. The female oviposits through the egg puncture of the host, laying an egg on the outside of the host egg. Eggs were deposited in the early part of October, but in the field they may be laid at a much later date. The length of the egg-stage is unknown, but eggs laid on 7th September contained what appeared to be fully developed larvae by 2nd November. After hatching, the larva probably eats the egg on which it is laid and then burrows through the pith of the cane, attacking any eggs of *O. niveus* that it encounters. The number of eggs consumed or injured in passing so that they become infected by moulds varies from ten to fifteen. The length of the burrow depends on the food-supply; one was observed that measured 15 inches. The duration of the larval stage could not be determined, but is probably about 10 months. Pupation took place during the early part of July at the end of the larval burrow, a distinct cell being formed by a plug of pith placed in the open end of the tunnel. The pupal period varied from 13 to 18 days under laboratory conditions.

This parasite was also reared from eggs of *O. californicus*, Sauss., and would probably attack the eggs of any species of *Oecanthus* that are accessible. An unidentified Pteromalid was found parasitising the larvae of *M. oecanthi*.

McDaniel (E. I.). **Soft Scales injurious to Deciduous Ornamentals.**—*Circ. Bull. Mich. Agric. Expt. Sta.*, no. 133, 17 pp., 11 figs. East Lansing, Mich., April 1930.

Brief notes are given on the appearance and life-history of the following Coccids that may infest deciduous trees and shrubs in ornamental plantings in Michigan : *Neolecanium cornuparvum*, Thro, which attacks all species of *Magnolia* ; *Toumeyella liriodendri*, Gmel., which infests tulip-tree [*Liriodendron tulipifera*], *Magnolia* and lime [*Tilia*] ; *Gossyparia spuria*, Mod. (*ulmi*, auct.), which feeds on many varieties of elm but appears to prefer the European elm [*Ulmus campestris*] ; *Kermes pubescens*, Bogue (burr oak kermes) and *Asterolecanium variolosum*, Ratz. (golden oak scale), which occur on oaks ; *Phenacoccus acericola*, King (maple false mealybug) and *Pulvinaria acericola*, Walsh & Riley (cottony maple-leaf scale), which infest maple ; and *P. vitis*, L. (cottony maple scale), *Lecanium corni*, Bch., *L.* (*Eulecanium*) *nigrofasciatum*, Perg. (terrapin scale) and *L.* (*E.*) *caryae*, Fitch, which are polyphagous.

Pettit (R. H.). **June Beetles or White Grubs in Michigan.**—*Circ. Bull. Michigan Agric. Expt. Sta.*, no. 132, 10 pp., 4 figs., 1 ref. East Lansing, Mich., April 1930.

In Michigan the more important species of *Lachnosterna* (*Phyllophaga*) have a three-year life-cycle, so that there are three distinct triennial

broods. The distribution and years of appearance of the adults of the three broods are discussed, and notes are given on the control of the adults and larvae.

WINTER (J. D.). **A preliminary Account of the Raspberry Aphids.**—*Tech. Bull. Minnesota Agric. Expt. Sta.*, no. 61, 30 pp., 3 figs., 32 refs. St. Paul, Minn., September 1929. [Recd. 1930.]

Previous records of the Aphids occurring on *Rubus* in North America and Europe are reviewed, showing their food-plants and synonymy, and notes are given on the biology of three species that are common in Minnesota, *viz.*, *Aphis rubicola*, Oestl., *Amphorophora rubi*, Kalt, and *Amphorophora rubicola*, Oestl.

A. rubi is commonly found on cultivated raspberry, but has also been taken on wild red raspberry and less frequently on blackberry and cultivated dewberry. After a period of hot, dry weather it becomes scarce on cultivated plants. Winged forms are not common during the summer, though they have been occasionally taken from June to October. Wingless forms are common on raspberry throughout the growing season. Oviparous females and alate males occur on raspberry in October. The eggs are laid singly in small numbers on the lower surface of the leaves or occasionally on the canes. Studies on the distribution of wingless forms of this Aphid, made in view of its importance as a vector of raspberry mosaic, showed that they may crawl to neighbouring bushes if they are dislodged from the foliage or if the plants on which they occur are dug up and begin to wilt. One variety of raspberry was found to be particularly resistant to *A. rubi*, the Aphids being unable to maintain themselves on it for any length of time.

Amphorophora rubicola is common on wild red raspberry in the northern part of Minnesota, but is scarce on cultivated plants. Both alate and apterous forms occur throughout the growing season. In 1925, alate males were found in one locality on wild raspberry as early as 15th September. Characters distinguishing this species from *A. rubi* are given.

Aphis rubicola is widely distributed on both wild and cultivated raspberry, but is more common on the former, over 200 individuals sometimes occurring on a single leaf. Alate forms may be quite numerous during the summer. The winter eggs are usually laid in the axils of the leaves.

COOK (W. C.). **Some Influences of Location upon Light Trap Catches.**—*Canad. Ent.*, lxii, no. 5, pp. 95–98, 2 refs. Orillia, Ont., May 1930.

Two similar light traps for capturing Noctuids, one situated in a field and the other in a third-storey window of a building, were operated concurrently in one locality during the seasons of 1928 and 1929 in Montana. Owing to adverse weather, the trap in the building was used on about forty more nights each season than the one in the field. A slightly greater number of moths was caught each night in the field trap, but not nearly so many species were captured, either for each collection or for the season. The trap in the building caught larger numbers of more than half of the most abundant species. Of twenty species of economic importance, five were equally attracted to both traps, and ten came more freely to the light in the building. Six of

these ten species, *viz.*, *Euxoa messoria*, Harr., *E. tessellata*, Harr., *E. ochrogaster*, Gn., *Chorizagrotis auxiliaris*, Grt., *Barathra configurata*, Wlk., and *Phytometra* (*Autographa*) *californica*, Edw., are of great economic importance, and are generally regarded as very slightly attracted to lights on the ground. The trap in the building seemed to attract many species that do not breed in the immediate vicinity but are quite common in a locality twenty miles away. This would indicate that it was in a much better position to capture migrating moths than the one in the field, which seemed to attract more local species.

Streeter (L. R.) & Rankin (W. H.). **The Fineness of ground Sulfur sold for Dusting and Spraying.**—*Tech. Bull. New York St., Agric. Expt. Sta.*, no. 160, 16 pp., 3 figs., 6 refs. Geneva, N.Y., April 1930.

The following is taken from the authors' abstract: A standard method of sieving sulphur is described, giving reliable results for sieves as fine as no. 326 [openings of 44 microns] of the United States Sieve Series established by the Bureau of Standards. Examination of six brands of ground sulphur sold for use as a fungicide showed this method to be useful only to distinguish one of the brands from the other five. A brief description of a micro-projection method of measuring sulphur particles is also given. By this method it was found that the five brands that appeared equally fine by the sieving test varied greatly as to their actual fineness. Since it seems probable that sulphur particles larger than 27 microns will fail to adhere to foliage, some of the brands on the market appear to be capable of improvement.

Knull (J. N.). **The Mexican Bean Beetle.**—*Bull. Pennsylvania Dept. Agric.*, xiii, no. 4, Gen. Bull. no. 489, 10 pp., 8 figs. Harrisburg, Pa., 1st April 1930.

A general account is given of the bionomics of *Epilachna corrupta*, Muls. (Mexican bean beetle) in Pennsylvania. It has now spread all over the State. Its seasonal occurrence depends largely on climatic conditions, but there are normally two generations a year. No natural enemy of any great importance has been observed, though nymphs and adults of the Pentatomid, *Podisus maculiventris*, Say, were found to feed on the larvae, pupae and adults. For dusting the lower surfaces of the leaves, 1 lb. magnesium arsenate, or lead arsenate, to 5 lb. hydrated lime is recommended, using 12 to 15 lb. to the acre, or for spraying, 2 lb. magnesium arsenate, or 2 lb. lead arsenate with 2 lb. hydrated lime, in 100 U.S. gals. water. Bean plants should be treated every 10–14 days from the time that the leaves unfold, the foliage being kept coated with poison throughout the growing season.

Newcomer (E. J.). **Killing Codling Moth Eggs on harvested Fruit.**—*Better Fruit*, xxiv, no. 12, p. 10. Portland, Ore., June 1930.

Eggs of the codling moth [*Cydia pomonella*, L.] often occur on harvested apples and pears, especially the early varieties, before they are packed for market. If the larvae are allowed to hatch, they cause considerable damage, particularly in pears for canning, which become infested while they are ripening. Cold storage at 26–33° F. for 5 days

only killed about half the eggs, and they were not affected by the ordinary washes used for removing spray residue. Fruit put through machines equipped with rotating brushes as well as the ordinary acid bath, however, was practically freed from eggs. Pears were also run through a standard fruit washing machine with several different emulsions of oil, with viscosities ranging from 50 to 130, and different strengths were used, both with and without a casein spreader. It was found that all eggs were killed when 1 or $1\frac{1}{2}$ gals. of emulsion were used in 100 gals. of water, no advantage being apparent in the use of a spreader. The heavier oils tended to retard ripening ; the lighter oils did not retard ripening, and the quality of the fruit was not affected. The emulsion may be made with the type of oil used for summer treatments, with viscosity of 50 to 60 and an unsulphonated residue of 90 to 100 per cent., or with oil such as is used in dormant sprays, with viscosity of about 100 and an unsulphonated residue of 60 to 70 per cent. The fruit should not be rinsed or dried, but allowed to ripen in the usual manner. This method has not been tried for apples and pears on a large scale, but it would seem to be quite practicable. It would probably be necessary to drain the tank and put in fresh emulsion two or three times a day, and it might be necessary to add a gallon or so of concentrated emulsion between drainings, as the fruit might carry away more oil than water. If spray residue has to be removed also, this might be done first ; the oil emulsion should not be mixed with the acid bath, as the acid must be rinsed off, whereas the oil emulsion must remain on the fruit.

BAKER (W. W.). [**Report of the**] **Department of Entomology.**—*Ann. Rep. West. Washington Expt. Sta. 1928–29*, pp. 10–16, 1 fig. Puyallup, Wash., October 1929. [Recd. 1930.]

Investigations on *Epitrix subcrinita*, Lec. (western potato flea-beetle) and *E. cucumeris*, Harr. (common potato flea-beetle) in Washington indicate that the latter is the principal pest of tubers [but *cf. R.A.E.*, A, xviii, 204], although both species cause severe injury to the foliage. They are so similar that identification of the adults in the field is difficult, and that of the larvae impossible. The oviposition period lasts several weeks, but there are at least two complete generations, and perhaps a partial third, during the season. Though the immature stages have been found as late as November and December, most of the beetles hibernate in the adult stage. Adults have been found feeding on cherry buds as early as 4th April, and become quite numerous in the potato fields during the latter half of the month. The larvae are found in the soil in the middle of June, but severe infestations do not occur until a month or six weeks later. If the tops of the potatoes are killed during a severe infestation, the adults migrate to other plants, including beans, tomatos and maize. It is not known definitely where most of the beetles hibernate, though some have been taken under the bark of trees. It is suggested that they migrate to the edges of the field, where they may be swept from trees and weeds in late September and October.

Although good results have been obtained by planting potatoes at certain dates in order to avoid injury [*loc. cit.*], it is not practicable to avoid planting between the middle of March and the end of June. The main crop of potatoes should be planted about the middle of June and the tops sprayed with Bordeaux mixture, at least twice at intervals of a week, as soon as the leaves begin to appear.

Byturus unicolor, Say (raspberry beetle) was prevalent on raspberries and loganberries during 1927–29. The adults appear in April and feed inside the folded leaves and later inside the young buds, where it is difficult to reach them with insecticides. Oviposition begins about a fortnight after emergence and continues for several weeks ; eggs were found during the middle of June. They are usually laid singly on the fruit petiole, on the bud or inside the blossom. The larvae, which cause the principal injury, eat through the under side of the calyx and into the blossom or the developing fruit. Salmon and thimble berries [*Rubus spectabilis* and *R. occidentalis*] are also occasionally attacked. The larvae pupate in the ground, the majority transforming into adults with the advent of cold weather, though hibernation is occasionally passed in the pupal or even the larval stages. The adults have been observed attacking the blossoms of bush blackberries, strawberries, plum, apple, etc., as well as those of the food-plants of the larvae. Clean cultivation in late summer and early autumn did not give such effective control as was expected. Experiments indicated that an arsenical spray, applied after the blossoms had opened, might be of some value. Nicotine dusts sometimes killed a large number of beetles, but their effectiveness varied in different years.

Pests of strawberries included : the weevils, *Tyloderma morbillosa*, Lec., which causes injury by burrowing into the crown of the plant, and *Dyslobus decoratus*, Lec., which in one locality was found feeding on the roots of cherry ; the Chrysomelid, *Timarcha intricata*, Hald., which was found attacking the foliage of the plants, but was not sufficiently abundant to justify control measures being taken against it ; and the Melolonthids, *Polyphylla crinita*, Lec., and *P. decemlineata*, Say.

Garman (P.). **The Oriental Peach Moth in Connecticut.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 313, pp. 401–451, 12 pls., 9 figs., 93 refs. New Haven, Conn., March 1930.

Cydia (*Grapholitha*) *molesta*, Busck (Oriental peach moth) causes injury in peach orchards amounting to more than £20,000 annually in Connecticut ; quinces are also seriously affected, and other fruits are occasionally attacked. The history of the moth in the United States and its bionomics are briefly discussed, and detailed accounts are given of laboratory and field experiments in its control. Arsenicals were found to be ineffective and dangerous to peach trees if applied repeatedly. Nicotine sprays or dusts and white oil emulsions reduce infestation to some extent, but not enough to warrant their employment, and lime sprays and talc dusts failed to afford protection in 1929 [*R.A.E.*, A, xviii, 405]. Against the moths, repellents are still in the experimental stage, and baits have not proved of use in the field. Although paradichlorobenzene is of some value against the hibernating larvae, it cannot be relied upon for complete control ; moreover, at the time that it is usually applied only a few of the larvae have spun their cocoons.

Measures recommended as being of some value are cultivation to a depth of 4 inches up to the trunks of the trees, to be completed not later than 15th May ; prompt destruction of all waste fruit and screening of packing sheds to prevent the escape of moths ; closing of the fruit sheds until the middle of July ; and treatment or destruction of containers in which the larvae have spun.

Periods of decline in infestation in some orchards have been found to coincide with a decided increase in parasites, particularly *Macrocentrus ancylivora*, Rohw. *Trichogramma minutum*, Riley, has been observed throughout the season in other localities. *Glypta rufiscutellaris*, Cress., has been abundant in some years, and a considerable number of *Eubadizon* sp. was found in one orchard. *M. delicatus*, Cress., has also been observed in Connecticut, and 25 other parasites, a list of which is given, occur in neighbouring States. *M. ancylivora*, the bionomics of which are briefly described [*cf.* xviii, 163], constituted 65 per cent. of all larval parasites of *C. molesta* in Connecticut in 1929 and was liberated in two localities, in one of which no parasites had been observed. Recoveries were made late in the season, and in the orchard where the parasite was already present, parasitism had increased from 1–2 per cent. in June to 80–100 per cent. *G. rufiscutellaris* constituted 70 per cent. of the parasites collected in one locality in 1928, but was completely absent there in 1929. The adults appear in August and September and frequently overwinter in the cocoons of *C. molesta*. There are apparently two generations a year. Both this parasite and *M. ancylivora* have also been reared from *Ancylis comptana*, Froehl. (strawberry leaf-roller) in Connecticut. Records are given of counts of *T. minutum*, which was found to be present in considerable numbers in some orchards, from eggs of *C. molesta* either normally present or placed in the field. Some success appeared to be obtained by attempts to increase the rate of parasitism by liberations, and organised laboratory breeding of supplies of this parasite and also of *M. ancylivora* has been undertaken.

BRITTON (W. E.). **Twenty-ninth Report of the Connecticut State Entomologist, 1929.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 315, pp. 479–620, 16 pls., 15 figs. New Haven, Conn., April 1930.

In addition to the usual pests that are met with every year in Connecticut, and those that have been mentioned in recent reports [*R.A.E.*, A, xvii, 607, etc.] or are dealt with in special papers below, the orchard pests recorded include *Psylla pyricola*, Först., and *Contarinia pyrivora*, Riley, on pears; larvae of the Lasiocampid, *Tolype velleda*, Stoll, on apple foliage; *Eulia velutinana*, Wlk. (red banded leaf-roller), which caused surface injury to stored apples in late autumn; *Conotrachelus nenuphar*, Hbst. (plum curculio), which was unusually prevalent on apples; *Cydia* (*Laspeyresia*) *molesta*, Busck, which was one of the most destructive pests of the year, especially in peach orchards; and *Malacosoma americana*, F., and *Alsophila pometaria*, Harr., which were less prevalent than formerly but still injurious in some districts. *Trialeurodes packardi*, Morrill, caused considerable injury to strawberries in one field. Shade and forest tree insects included *Lithocolletis hamadryadella*, Clem. (white oak leaf-miner); *Nepticula sericopeza*, Zell., mining in the petioles of Norway maple [*Acer platanoides*]; *Agrilus anxius*, Gory (bronze birch borer), which kills white birch; *Plagiodera versicolor*, Laitch., which skeletonises willows; *Fenusa pumila*, Klug (birch leaf miner); *Colopha ulmicola*, Fitch (cockscomb elm gall); *Prociphilus imbricator*, Fitch (beech woolly aphis); *Chermes* (*Adelges*) *pinicorticis*, Fitch, on white pine [*Pinus strobus*]; *C.* (*A.*) *abietis*, L., and *C.* (*Gillettea*) *cooleyi*, Gill., which are increasing in numbers, on spruces; *Toumeyella liriodendri*, Gmel., on tulip tree [*Liriodendron tulipifera*] and *Magnolia*; *Leucaspis japonica*, Ckll., on maples; and *Paratetranychus ununguis*, Jac. (spruce mite) on various

conifers. *Tortrix* (*Archips*) *rosana*, L., was abundant on privet, and young conifers were damaged by *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F. (black vine weevil) and *O.* (*B.*) *ovatus*, L. (strawberry weevil).

Stilpnotia salicis, L. (satin moth), which was found in Connecticut in 1926, is now widespread over the eastern part of the State, and the Federal quarantine has been extended to cover the area of its occurrence. *Anomala orientalis*, Waterh. (Asiatic beetle) also appears to be spreading in lawns, and *Aserica castanea*, Arrow (Asiatic garden beetle) was found during 1929 in several localities. *Epilachna corrupta*, Muls. (Mexican bean beetle) was discovered during the year on beans in the western part of the State ; another Coccinellid, *Ceratomegilla fuscilabris*, Muls., and the Pentatomids, *Stiretrus anchorago*, F., and *Podisus maculiventris*, Say, are predacious upon it in Connecticut. *Phorocera claripennis*, Macq., *Sarcophaga* (*Helicobia*) *helicis*, Towns., and *Paradexodes epilachnae*, Ald., which have been reared as parasites, the first two in Alabama and the third in Mexico, are also found in the State. Brief notes are given on the insecticides that have proved successful elsewhere, and a bibliography of 15 works is appended. The campaign against *Popillia japonica*, Newm., which included soil treatment, scouting and the use of traps, is described by W. E. Britton and J. P. Johnson.

R. B. Friend records injury to golf greens by larvae of *Crambus leachellus*, Zinck. ; greens treated with lead arsenate showed little or no injury [*cf. R.A.E.*, A, xviii, 172].

The inspection of nurseries and of imported nursery stock is reported on by W. E. Britton and M. P. Zappe, pests intercepted including *Aporia crataegi*, L., and the woolly aphis [*Eriosoma lanigerum*, Hausm.] on apple, and *Calophasia lunula*, Hb., on pear, from France ; *Emphytus cinctus*, L., on rose from France, England and Holland ; and eggs of *Notolophus antiquus*, L., on cherry from France and apple and rose from Holland.

The same authors record a marked spread westward in the area infested by *Pyrausta nubilalis*, Hb. The whole area has been brought under State and Federal quarantine, and legislation has been passed rendering clean cultivation compulsory. The differences between *P. nubilalis* and other burrowing larvae found in maize are explained.

The situation with regard to the gipsy moth [*Porthetria dispar*, L.], reported upon by J. T. Ashworth and W. E. Britton, remains practically unchanged since the previous report [xvii, 609], and work is being continued on the same lines. The cost of spraying woodland for the control of this moth is discussed by R. B. Friend and N. Turner.

Various apple sprays were tested by M. P. Zappe, who found that iron sulphate ($1\frac{1}{2}$ lb. to 100 U.S. gals.) did not appear to be of much value in preventing the spray injury believed to be due to the use of lime-sulphur in combination with other materials.

GARMAN (P.). **A Study of various Oils and Emulsions for killing the Eggs of the European Red Mite.**

Experiments with Oils on a double Infestation of Aphids and European Red Mites at the Experiment Farm at Mount Carmel.—*Bull. Connecticut Agric. Expt. Sta.*, no. 315, pp. 571–575 & 576–578. New Haven, Conn., April 1930.

The author's conclusions, drawn from laboratory investigations with oils against eggs of *Paratetranychus pilosus*, C. & F. (European red mite),

are as follows: Heavier oils are more effective than light, when emulsified on the same formula. An emulsion with large oil globules is slightly more effective than one with small globules. The differences obtained are, however, of doubtful importance. Fuel oil added to lubricating oils lowers their toxicity. Oils dissolved in petrol may be used to compare different oils of the same or different properties. There is some indication that the addition of lime-sulphur to stabilised emulsions increases the kill. The results of the tests and the analyses and physical constants of the oils are shown in tables.

In 1929, field experiments were carried out on apple with lime-sulphur (12 : 100) containing nicotine sulphate (1 : 400), and with miscible oil and a commercial oil emulsion containing ammonium caseinate, either alone or in combination with other materials, against *P. pilosus* and Aphids. The sprays were applied when the leaves were well advanced, but foliage injury was not serious. In the case of the Aphids, the best results were obtained with lime-sulphur and nicotine sulphate, the combinations of oil emulsion with nicotine sulphate or free nicotine ($1\frac{1}{2}$: 800) ranking next. Very little difference could be seen in the two latter combinations, probably because the emulsion used contains a large amount of free ammonia, which may act on nicotine sulphate to free the nicotine rapidly. The oil emulsion alone was much less effective than the miscible oil alone. In the case of *P. pilosus*, the order of effectiveness was the same, but few or no mites were present at the beginning of the experiment on the trees treated with lime-sulphur and nicotine sulphate or with miscible oil.

TURNER (N.). **Notes on Life History and Control of the Pine Leaf Scale.**—*Bull. Connecticut Agric. Expt. Sta.*, no. 315, pp. 578–581, 5 refs. New Haven, Conn., April 1930.

Chionaspis pinifoliae, Fitch (pine leaf scale) is a serious pest of young pine trees in Connecticut, hindering the growth of seedlings and sometimes killing them, and injuring older trees growing in shady situations. Hemlock (*Tsuga canadensis*) is also attacked. Investigations on *Pinus sylvestris* during 1929 showed two distinct generations, larvae from overwintering eggs first appearing on 18th May and maturing early in July, and a second generation beginning to appear in early August. From experiments described, it is recommended that sprays should be applied wherever possible against the first generation, using nicotine sulphate, 1 : 500, with 1 per cent. soap, or white oil at 1 per cent. strength about ten days after the first larvae appear. If sprays for the second generation are necessary, one application of the white oil should be made a week after the first larvae appear or one application of nicotine sulphate followed by a second two weeks later.

BRITTON (W. E.). **Control of Ant Invasions.**—*Bull. Immed. Inf. Connecticut Agric. Expt. Sta.*, no. 67, pp. xxv–xxx, 2 figs., 6 refs. New Haven, Conn., 20th July 1929. [Recd. 1930.]

In this revised edition of a previous bulletin [*R.A.E.*, A, xi, 382] it is suggested that in addition to naphthalene, borax, paradichlorobenzene, camphor, cedar oil, tobacco, sulphur, powdered cloves, mustard or insect powder [pyrethrum] may be used as repellents against ants in houses and should be scattered on shelves and floors, at the points of entrance, and along the runways. Ants congregate in large numbers

on plates greased with lard and may subsequently be killed with hot water. In most cases calcium cyanide may be used as a fumigant for the nests in place of carbon bisulphide, but it is not recommended on lawns, as turf is usually killed by it.

BUTLER (O.) & JENKINS (R. R.). **Effect on Plants of Cyanide Fumigation following Spraying with Bordeaux Mixture.**—*Phytopathology*, xx, no. 5, pp. 419–429, 6 figs., 6 refs. Lancaster, Pa., May 1930.

Serious injury to plants is sometimes caused, apparently by the formation of soluble cupric cyanide, as a result of fumigating with hydrocyanic acid gas after spraying with Bordeaux mixture. Experiments to determine the effect of the composition of the spray on the injury are described. The most commonly used mixture (1 : 1) is generally the most injurious. The following is the authors' summary:—

The formation of cupric cyanide in a Bordeaux mixture exposed to cyanide fumigation is determined by the ratio of copper sulphate to quick lime used in making the mixture. Cupric cyanide does not form when the ratio employed is 1 : 0·2 and in negligible amount only when the ratio is 1 : 4 or higher. In a 1 : 0·2 mixture insoluble cuprous cyanide is formed; in a 1 : 6 mixture a soluble double cyanide. In mixtures of ratios greater than 1 : 1 but less than 1 : 6 the amount of cupric cyanide formed decreases with increase in calcium hydrate, and the double cyanide becomes more abundant. A Bordeaux mixture, forming with hydrocyanic acid gas a double cyanide, is injurious if sprayed and fumigated plants are wetted.

A neutral Bordeaux mixture, or an approximately neutral mixture, is the only type to be recommended when the sprayed plants are to be subjected to cyanide fumigation. It should then be used on plants that are no more sensitive to soluble copper than is the tomato.

Record of current Work, July 1 to December 31, 1929.—*U.S. Dept Agric., P.Q.C.A.*, S.R.A., no. 101, pp. 182–208. Washington, D.C., June 1930.

An account is given of the situation in the United States with regard to the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], the gipsy and satin moths [*Porthetria dispar*, L., and *Stilpnotia salicis*, L.], the European corn-borer [*Pyrausta nubilalis*, Hb.], the Mexican fruit-worm [*Anastrepha ludens*, Lw.], the Japanese beetle [*Popillia japonica*, Newm.], the Asiatic and Asiatic garden beetles [*Anomala orientalis*, Waterh., and *Aserica castanea*, Arrow], the pink bollworm [*Platyedra gossypiella*, Saund.], the thurberia weevil [*Anthonomus grandis thurberiae*, Pierce], and the date scale, *Parlatoria* [*blanchardi*, Targ.].

Although the renewed infestation of *A. ludens* in the western part of the lower Rio Grande Valley of Texas, reported in April 1929 [*R.A.E.*, A, xviii, 353], appears to have been completely eradicated, a small infestation was discovered in November 1929 at Brownsville at the eastern extremity of the cultivated area. The fruit in this area and about 100 sour orange trees were destroyed within 8 days of the discovery of the infestation, which was apparently due to the spread of the fruit-fly from Matamoros, Mexico, where it was found to be established on 8th September. In co-operation with the Mexican Government, all ripe and ripening fruit growing in Matamoros was destroyed

between 25th September and 12th October, and the trees were subsequently treated with a bait-spray of 8 lb. lead arsenate, 10 lb. molasses and 50 lb. sugar to 200 U.S. gals. water. This spray was repeated every 5–10 days and was still being continued at the end of December in both Brownsville and Matamoros.

Fumigation with carbon bisulphide of crates of blackberries intended for shipment from an area infested with *P. japonica* was entirely effective in destroying the beetles infesting them, and no injurious effect on the berries was observed.

HAWKINS (L. A.). **Heat Sterilization of Citrus Fruit.**—*U.S. Dept. Agric., P.Q.C.A.*, S.R.A., no. 101, pp. 225–227; no. 102, pp. 25–27. Washington, D.C., June 1930.

General recommendations are given as to the methods of sterilising citrus fruit according to the recent requirements of the quarantine against the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] [*R.A.E.*, A, xviii, 22]. The temperature of the fruit, which should be of good quality, should not be above 112° F. at any time during the entire period of sterilisation, and it should be brought up evenly throughout the room. If an attempt is made to heat it too quickly, some of the fruit may be overheated, whereas if it is heated too slowly, some of the fruit will be kept at high temperatures too long while the temperature of the coldest fruit is being raised. It should be possible, with good equipment, to heat all the fruit in the room to 110° F. in 8–12 hours, without raising the temperature of any of the fruit above 111° F. Coloured fruit should be removed from the sterilisation room immediately after treatment and allowed to stand on the floor of the packing house uncovered for at least 12 hours before packing.

Rules and Regulations made by the State Plant Board pursuant to the Florida Plant Act of 1927. Federal Regulations.—*Mon. Bull. Pl. Bd. Florida*, xiv, no. 8–11, pp. 213–229, 230–253. Gainesville, Fla., February–May 1930.

The State regulations on account of *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) [*R.A.E.*, A, xvii, 509, 662] are published in their entirety to include all alterations enacted from December to May 1930; and the Administrative Instructions relating to the Mediterranean fruit-fly Quarantine issued by the United States Department of Agriculture during the same period are given in full.

Mediterranean Fruit Fly Quarantine. Notice of Quarantine no. 68 (revised) with Revised Rules and Regulations supplemental to Notice of Quarantine no. 68.—*U.S. Dept. Agric., P.Q.C.A.*, multigraph 21 pp. Washington, D.C., 1930.

This general revision of the regulations under the quarantine against *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) in Florida [*R.A.E.*, A, xvii, 508, 661] became effective on 15th August 1930, from which date all previous regulations and revisions were superseded. Since only three infestations, each limited to one or two fruits, have been discovered in Florida during the past 11 months, some of the more stringent requirements enforced in 1929 are no longer required. The movement of sterilised fruit (other than limes, which need not be sterilised) and of

unsterilised vegetables, including tomatos, egg-plants [*Solanum melongena*] and lima and broad beans (*Phaseolus lunatus* and *Vicia faba*) from the regulated area of Florida to the southern and western States is authorised throughout the entire shipping season or until further notice, but peppers [*Capsicum*] have been found so susceptible that they must still be sterilised if moved to these States. The State Plant Board is authorised to reduce the size of the infested areas to include properties within ½ mile (instead of 1 mile) from points of infestation. The requirement of sterilisation of fruit shipped to the middle western States from points outside the infested areas is discontinued. Blackberries, dewberries, mulberries, cotton bolls and seed cotton are added to the list of products exempt from the fruit-fly regulations. The harvesting and marketing period of the commercial Florida citrus crop is extended to 15th June 1931, and re-shipment regulations restricting the transportation of Florida fruits and vegetables susceptible to infestation from the north-eastern States to the Middle West are removed.

DAVIS (J. J.). **Protecting Shade Trees and Shrubs against Insects.**—*Extens. Bull. Purdue Univ. Dept. Agric. Extens.*, no. 168, 36 pp., 20 figs. Lafayette, Ind., May 1930.

In view of the importance and value of shade trees and shrubs in Indiana, the author deals with the general principles of insect control and discusses 26 of the commoner pests of shade trees in the State.

[**Papers on the Pests of Pecan in Mississippi.**]—*Quart. Bull. Mississippi Pl. Bd.*, ix, no. 4, pp. 1–14. A. & M. College, Miss., January 1930.

In the first paper, "The Hickory or Pecan Shuckworm" by H. S. Adair, a brief general account is given of the bionomics and control of *Enarmonia* (*Laspeyresia*) *caryana*, Fitch, with a description of the damage caused by the larvae to pecan nuts [*cf. R.A.E.*, A, vi, 226]. Most of the mature larvae, after hibernating in the husks, pupate in the early spring, and the moths emerge from March to May. Some of the larvae, however, do not pupate until late in the summer, and others may even pass a second winter in the husks. Moths will oviposit on leaves and leaf-stems, but *Phylloxera* galls and nuts are preferred, and as nuts are not available until the latter part of May, it appears that moths emerging early are only responsible to a slight extent for the infestation of pecan groves unless the trees are infested with galls. The major infestation in commercial groves is evidently due to moths that emerge late. A generation is completed in *Phylloxera* galls before the nuts have set, and the moths emerging from groves infested with galls or from galls on hickory growing adjacent to pecan trees may serve to increase the infestation of small nuts.

Records taken during the summer of 1929 showed that the egg stage averaged about 5 days, the larval stage 24, and the pupal stage 9. There are usually four generations during the summer, but considerable overlapping occurs, and all stages may be present at the same time during the period from the latter part of May until October. The larvae feed inside the nuts or husks, except at the time they are burrowing into them, and as they cast aside the first bites of tissue removed, little if any of the

surface is consumed. Ploughing the husks under is not considered a satisfactory control measure [but *cf.* xvii, 85]. It is recommended that at harvest time the nuts should be separated from the husks with a flail on large sheets, so that the husks, which contain the overwintering larvae, can easily be collected and destroyed.

Several parasites attack the larvae of *E. caryana*, of which the most important are probably *Phanerotoma tibialis*, Hald., *Calliephialtes grapholithae*, Cress., *Microbracon cushmani*, Mues., *Tachinophyto variabilis*, Coq., and a species of *Perisierola*. *Trichogramma minutum*, Riley, has been reared from the eggs.

In "The Pecan Shuckworm in Mississippi" by H. Gladney, J. P. Kislanko and J. M. Langston, data are given on the rate of infestation, times of emergence and extent of parasitism in different localities in Mississippi. *E. caryana* is considered a minor pest of pecan except in the southern part of the State. The highest rate of parasitism observed was 17·8 per cent.

In a paper on "The Black Pecan Aphid (*Myzocallis fumipennellus*, Fitch)" J. P. Kislanko gives an account of observations on this Aphid, which in association with *Callipterus* (*Monellia*) *costalis*, Fitch, and *C.* (*M.*) *caryae*, Monell, caused severe defoliation of one variety of pecan in a certain district of Mississippi in 1929. Alate individuals were found on the lower surface of pecan leaflets on 10th April. The infestation reached its maximum in August and September, after which it decreased, Aphids being scarce during the latter part of October. No sexual forms were found until 22nd October, when three apterous oviparous females and two males were collected. The Aphids appear to prefer one variety of pecan. Dusting with superfine sodium fluosilicate gave unsatisfactory results, but experiments indicated that the Aphids could be controlled with 2 per cent. home-made nicotine dust if it were applied to the entire orchard at the time they appear. During dusting experiments 214 dead individuals of *M. fumipennellus* and 407 individuals of the other two species were collected from beneath one tree on 1st July, whereas 4,464 dead individuals of the former and only 432 of the latter were collected from the same tree on 14th August. Severe infestation by Aphids affects the quality of the nuts by causing premature defoliation.

In "Some Experiments with the Pecan Weevil" J. M. Langston points out that although *Curculio caryae*, Horn, causes no injury to pecans in the southern part of the State, where most of the commercial groves are situated, it frequently infests them in other districts, especially when the groves are near forests containing hickory trees. Experiments indicate that the life-cycle of this weevil lasts two years and that possibly some of the larvae produce adults in the third year. It does not spread rapidly and seldom causes much damage.

J. P. Kislanko in "Notes on Pecan Leaf Case Bearers" states on the authority of Heinrich that the principal species in Mississippi is *Acrobasis juglandis*, LeB., and not *A. nebulella*, Riley [*cf.* vi, 168 ; xiii, 565], which does not feed on pecan, hickory or walnut. A second species was identified as *A. cunulae*, Dyar & Heinr. From cases of both species kept in cages the majority of the moths emerged between 23rd May and 11th June. Dipterous parasites emerged between 13th and 27th May (one emerging on 8th June), and most of the Hymenopterous parasites emerged between 16th May and 3rd June. Examination of cases collected in the middle of May showed that the adults of *A. cunulae* emerge somewhat earlier than those of *A. juglandis*, and that the latter was about 8½ times as numerous as the former.

Entomology.—*48th Ann. Rep. Ohio Agric. Expt. Sta. 1928–29,* Bull. 446, pp. 78–93, 1 fig. Wooster, Ohio, February 1930.

Infestation by *Cydia* (*Laspeyresia*) *molesta*, Busck, as recorded by L. A. Stearns and R. B. Neiswander, continued to spread in 1929 in the important peach-producing areas at the western extremity of Lake Erie, 75 per cent. of the peach crop and 20–33 per cent. of some varieties of apple and pear being injured in severe infestations, and quinces in small plantings being a total loss. Life-history studies indicate that the moths are most active in the evening and that oviposition occurs most frequently between 6 and 9 p.m. On peach, 95 per cent. of the eggs were deposited on the lower surface of the leaves. The larvae entered one variety of apple, on an average, 74 minutes after hatching, ingesting little if any, of the surface tissue. A list is given of 17 larval and pupal parasites of *C. molesta* recorded from Ohio. An average parasitism of 15 per cent. was recorded during the summer of 1929, *Macrocentrus ancylivora,* Rohw., which amounted to 78 per cent. of the parasites reared, being the predominating species in the south and *Glypta rufiscutellaris,* Cress., in the north of the State.

A $12\frac{1}{2}$ per cent. tar acid oil gave 90 per cent. control of hibernating larvae in cocoons on peach wood. A spray of hydrated lime [*cf. R.A.E.*, A, xvii, 723], 25–40 lb. to 50 U.S. gals. water, was 80 per cent. effective as a repellent to oviposition ; 19 per cent. as an ovicide and 87 per cent. as a larvicide. Summer oils, at 2 per cent. strength, showed corresponding efficiencies of 76, 98 and 72. A combination of the lime and oil proved much less effective as a repellent to oviposition, more effective as an ovicide and about equally effective as a larvicide. In spite of excessive rainfall during the spraying period, a reduction of 25–56 per cent. in infestation of peaches was effected by spraying, and no undesirable residue was found on the fruit at harvest. The growth of the treated trees exceeded that of the untreated ones, and the former produced an increased crop of larger fruit and increased fruit-bud formation. The spraying schedule suggested as the result of the experimental spraying has already been noticed [xviii, 388].

C. R. Cutright and J. S. Houser report that a trial of the addition of fish-oil to sprays of lead arsenate and lime-sulphur resulted in a reduction of 10 per cent. in injury to apples by *Cydia* (*Carpocapsa*) *pomonella,* L., and the plum curculio [*Conotrachelus nenuphar,* Hbst.], as compared with a plot treated according to the regular schedule, no foliage injury occurring throughout the season. Another trial showed that 4 oz. of fish-oil must be added for every additional pound of solid material, such as dry lime-sulphur or hydrated lime used in the spray. A field experiment in 1929 showed that the addition of 2 lb. hydrated lime to 50 U.S. gals. of lead arsenate and lime-sulphur spray reduced the effectiveness of the arsenate in one instance as much as 20 per cent. against *C. pomonella.* The addition of nicotine to lead arsenate and oil sprays greatly increased the mortality of codling moth larvae during the first 48 hours after spraying, but from that time onward little difference in infestation was noted.

Cutright states that although the most generally severe outbreak of *Anuraphis roseus,* Bak., for 6 years occurred on apple in Ohio in 1929, little commercial injury was caused. Trees sprayed with lime-sulphur at dormant strengths with the addition of nicotine sulphate, 1 : 800 or 1 : 1,000, were almost entirely free from Aphids. Spraying against *Aphis pomi,* DeG., in the delayed dormant period has little effect, as the summer infestations always arise from migrations in late May or early

June. It is therefore recommended that no spraying be done directly against this Aphid until it is observed in numbers on the trees. The most effective spray is nicotine sulphate $\frac{3}{4}$ pt. to 100 gals. water, to which is added $\frac{3}{4}$ gal. commercial miscible oil or 1 gal. oil emulsion. Studies still in progress indicate that infestation may be reduced by a system of pruning that is unfavourable to water sprout growth and by frequent removal of water sprouts from the trees. Trees that have been pruned so that water sprouts are abundant should receive special sprays against Aphids. Laboratory tests at varying temperatures with sulphur alone and in combination with a number of materials against *Paratetranychus pilosus*, C. & F., on apple showed that the only possible results against the mite are to be obtained by application when the temperatures are unusually high.

Houser reports that laboratory studies in the control of *Rhynchaenus* (*Orchestes*) *pallicornis*, Say (apple flea weevil), which increased to considerable numbers in 1928 and the early part of 1929, showed the outstanding efficiency of two fluosilicates and an extract of pyrethrum. Injury from this weevil was almost entirely prevented during July and August owing to parasitism by Hymenoptera, which developed at midsummer.

Work on the control of *Epitrix cucumeris*, Harr., on potato, discussed by H. L. Gui, indicates that the greatest benefit is derived from the use of insecticides in conjunction with Bordeaux mixture. The differences in numbers of flea-beetles, however, resulting from the addition of insecticides were not accompanied by increased yields, so that on the whole the results emphasise the necessity for thorough spraying with Bordeaux mixture and cast some doubt on the value of insecticides in the control of *E. cucumeris*. Less damage was done to potato by *Pnyxia scabiei*, Hopk., than in any one of the three previous years. Experimental plots continued to show that this Mycetophilid does more damage in soils having a reaction near the neutral point than in soils that have been rendered strongly acid by the addition of sulphur [xvii, 451], though this is counterbalanced by a somewhat reduced yield in such soils.

C. R. Neiswander records an unusual infestation of *Papaipema nitela*, Gn., in maize during July 1929. The damage occurred uniformly over eight acres, about one-third of the plants being killed and a considerable percentage of the remainder injured. It was discovered that the eggs had been deposited in the previous autumn in clumps of *Agrostis alba* and had survived owing to inadequate ploughing of the field. On hatching, the larvae had fed on the grass until they grew too large for the stems to contain them, whereupon they had migrated to the maize, reaching the migrating stage early in July. *Oligia fractilinea*, Grote, which is destructive to maize every year in that section of Ohio where timothy grass [*Phleum pratense*] is grown, has never been observed to attack maize except where timothy has preceded it for two or three consecutive years. The eggs are laid on the grass, where the larvae make their early growth, and the artificial conditions produced by the cropping system are alone responsible for the change of food-plant.

L. L. Huber, J. R. Savage and E. A. Herr report that in spite of a late spring and generally later planting of maize, infestation by *Pyrausta nubilalis*, Hb., increased greatly in certain areas. In every instance the increase could be accounted for by the nature of the soil, a sandy loam, which made it possible to plant maize in spite of the wet spring. Abundant moisture combined with temperatures conducive to growth

produced rapid growing and vigorous maize, which is specially attractive to the adults and favourable to high larval survival. Neiswander, J. B. Polivka and Herr state that the relatively high temperatures and a wet spring induced early moth emergence in 1929. Emergence began on 17th June and reached a maximum on 29th June, 97 per cent. of the moths having been in flight by 7th July. Of the total eggs deposited for the whole season, 66 per cent. were laid between 5th and 12th July. Taking beech-maple as unfavourable and all other types of habitat as favourable, Savage, Polivka and E. G. Kelsheimer have determined the approximate percentage of favourable habitats of *P. nubilalis* for a number of townships and correlated them with the average infestation percentages for 1927 and 1928. The correlation coefficient is ·4233 with odds of 1,454 to 1 that the correlation is significant. This shows the existence of a relationship between habitats and infestation and indicates that the most serious infestations occur locally in regions that were formerly swamp forest or wet prairie, the most favourable of all the types of habitat found within the infested area.

Control recommendations by Huber and Neiswander include practical clearing of crop remnants, modification of the planting date so that early planting on productive soils is avoided, and the utilisation of resistant varieties.

Young (H. C.). **Water-soluble Arsenic in Spray Material.**—*Bull. Ohio Agric. Expt. Sta.*, no. 448, 22 pp., 6 figs., 15 refs. Wooster, Ohio, March 1930.

Mixtures of lime-sulphur and lead arsenate in summer sprays are apt to scorch foliage on account of the liberation of water-soluble arsenic in the mixture. The more dilute the lime-sulphur up to at least 1 : 100, the greater the amount of water-soluble arsenic. The author describes a series of experiments that explain, at least in part, the reason for the somewhat spasmodic occurrence of injury to foliage. When lime-sulphur and lead arsenate are mixed in a spray, a black precipitate is formed that contains lead sulphide, arsenic being liberated as the lead unites with the sulphur. Freshly made hydrated lime high in calcium is effective in reducing the water-soluble arsenic in such mixtures ; hydrated limes high in magnesium are less effective. The addition of a high calcium hydrated lime, however, although reducing injury, also reduces the efficiency as a fungicide, and the unpublished results of recent experiments indicate that 2 lb. lime to 50 U.S. gals. of spray material appreciably reduces the efficiency of lead arsenate against the codling moth [*Cydia pomonella*, L.]. Apparently, anything that reduces injury by fungicides and insecticides also lowers their efficiency. Calcium carbonate, calcium caseinate, and iron, aluminium, barium and zinc compounds are valueless as correctives. Manganar (manganese arsenate) does not react with lime-sulphur to produce water-soluble arsenic, and wettable sulphur sprays react only slightly with lead arsenate and manganar ; this substance is being extensively tried in the field, both as regards its effect upon sulphur and its control of insects. Until definite substitutes are developed, it is impossible to avoid injury either by scorching or by pests. There are undoubtedly many other factors that account for variations in the final yield of soluble arsenic, such as temperature, period of drying, etc.

Richardson (C. H.) & Shepard (H. H.). **The Insecticidal Action of some Derivatives of Pyridine and Pyrrolidine and of some Aliphatic Amines.**—*J. Agric. Res.*, xl, no. 11, pp. 1007–1015, 6 diagrs., 15 refs. Washington, D.C., 1st June 1930.

An account is given of investigations on the relative toxicity to *Aphis rumicis*, L., of various nitrogenous organic compounds, including derivatives of pyridine and pyrrolidine and of some aliphatic amines, synthesised by F. B. La Forge [*cf. R.A.E.*, A, xvii, 729]. Many of these compounds are structurally related to nicotine. Metanicotine and nicotyrine were the only substances tested that showed a toxicity approaching that of nicotine. It is pointed out that the cyclic pyrrolidine ring of nicotine may be replaced by an aliphatic amine group, as in metanicotine, with only a partial reduction in the toxicity of the original compound. It is therefore possible that other aliphatic amines of simpler structure might be substituted in the β position of pyridine to form compounds that would be highly toxic to insects. The relation of chemical structure to toxicity, particularly hydrogenation and methylation of certain groups, is briefly discussed.

Benzylpyridine appears to show some promise as an insecticide for use in cases where oily properties are advantageous but where an ordinary cheap oil is not suitable.

Ginsburg (J. M.). **Test to determine Toxicity of Pyrethrum Vapors to Honeybees.**—*J. Agric. Res.*, xl, no. 11, pp. 1053–1057, 1 fig., 19 refs. Washington, D.C., 1st June 1930.

Larvae of *Malacosoma americana*, F., transferred to apple trees sprayed one hour previously with an alcoholic suspension of pyrethrum flowers, died within 24 hours, whereas caterpillars transferred to the same trees 5 days later were unaffected. The question arose as to whether the cessation of toxicity was due to the decomposition of pyrethrum when exposed to light or to exhaustion of the volatile material emanating from it. Experiments were therefore undertaken in which the volatile material from finely ground flowers and extracts of pyrethrum was circulated continuously through chambers containing bees. At the end of 48 hours the bees appeared normal and were evidently not affected by the vapour. The cessation of toxicity of the pyrethrum spray to *M. americana* was therefore not due to the exhaustion of the essential oils but to other factors, which possibly decomposed the active principles. The toxicity of the ground flowers, as well as the extracts, of pyrethrum seems to be due primarily to the non-volatile substances, namely, pyrethrins I and II.

Department of Entomology and Zoology. *Ann. Rep. Tech. Serv. Dept. Agric. Haiti, 1928–29,* Bull. no. 17, pp. 157–166, 5 figs. Port-au-Prince, Haiti, 1929. [Recd. 1930.]

Notes are given on a number of cotton pests observed in Haiti during 1928–29 [*cf. R.A.E.*, A, xvi, 50]. Experiments showed that *Alabama argillacea*, Hb., can be easily controlled by spraying with 2 lb. calcium arsenate and 4 lb. lime to 50 U.S. gals. water. It may considerably reduce the yield of the crop during a very hot season, or when infesting poorly developed plants. Its rate of development varies with the time of year, the egg, larval and pupal stages lasting 2–4, 8–14, and

5–10 days, respectively. The adults lived for about 2 weeks. Under controlled experiments, 13 generations were reared during the year. Cotton is also attacked by *Anomis doctorium*, Dyar, but this moth is far less abundant than *Alabama*. *Dysdercus andreae*, L. (cotton stainer) is the most important pest of cotton, the principal injury, which varies from 10 to 50 per cent., being due to the fact that its feeding punctures are responsible for the spread of fungous and bacterial diseases, which cause the bolls to decay and to drop off before ripening. Outbreaks occurred in one locality in November and December. The adults feed on the fallen bolls and lay their eggs on the ground beneath them. When most of the nymphs had hatched, the soil round the plants was dusted with calcium cyanide and the plants jarred, thus causing the nymphs and adults that had already crawled up them to fall to the ground. Fallen leaves and débris were raked over, thus exposing any bugs that were hiding beneath them. Almost complete control was thus effected, and any adults that subsequently appeared on the plants were jarred off into pans containing oil. *Prodenia ornithogalli*, Guen., which injured young plants of cotton, was held in check by a poison bait of sawdust mash, applied in the evenings.

Feterita [*Sorghum*] heads in the field were heavily infested by the rice weevil [*Calandra oryzae*, L.], the grain weevil [*C. granaria*, L.], the Angoumois grain moth [*Sitotroga cerealella*, Ol.] and small Tenebrionids ; these pests, together with the confused flour beetle [*Tribolium confusum*, Duv.], also cause very serious damage to stored cereals. Fumigation of the grain, if it is stored in air-tight bins, or heating it at temperatures of from 115 to 150° F. will control these pests.

Coffee beans in storage were infested by the Dermestid, *Lasioderma serricorne*, F., both the larvae and adults of which cause serious injury. Observations on an apparently undescribed species of cricket attacking coffee, show that the eggs, the incubation period of which lasts a year, hatch from January to July, and that the life-cycle is completed in two years. The males were found hiding in banana leaves. The crickets are serious pests at low altitudes, damaging the plants by their egg-punctures so that the branches break under a heavy load of berries. Injury to coffee, especially to bushes in very dry areas and those insufficiently protected from the sun, is caused by *Lecanium* sp. and a green armoured scale ; the latter is by far the more injurious, and when abundant, may even kill the plants.

The native strain of maize is not seriously attacked by the corn ear worm [*Heliothis obsoleta*, F.], but other varieties were more or less severely injured, according to the amount of sugar in the stalk or grain, a crop of sweet corn being completely ruined by *H. obsoleta* and the fall army worm [*Laphygma frugiperda*, S. & A.].

Phthorimaea operculella, Zell., is the most important pest of tobacco in Haiti. The eggs are laid on the leaves and hatch in about two days. The larva draws two leaves together to form a shelter within which it feeds on the surface of the leaves, and pupates after 7 days, the pupal period lasting 5 days. The generations are continuous throughout the season, the plants becoming infested in the beds before transplanting. Infestation was held in check by dusting the young plants with lead arsenate, from the two-leaf stage until they were transplanted. Other pests of tobacco were ants, which infest beds of seedlings, and were controlled by a poison bait of maize meal and Paris green ; and

Sphingid larvae, which were successfully destroyed by a dust of lead arsenate and lime, though calcium arsenate scorched the foliage even when mixed with lime.

Vegetable pests included *Empoasca* [*fabalis*, DeLong], which was found to transmit yellows disease of beans [*cf. R.A.E.*, A, xviii, 494]; *Phthorimaea operculella*, which was abundant on tomatos; *Diaphania* (*Margaronia*) *hyalinata*, L., on cucurbits; and ants, which caused serious injury to egg-plants (*Solanum melongena*) and beans, but were successfully controlled on ground-nuts by flooding.

BONDAR (G.). [**Miscellaneous Pests in Bahia.**]—*Bol. Lab. Path. veg.*, no. 8, 53 pp., 5 figs. Bahia, 1929. [Recd. 1930.]

This is a report on various insect pests of cultivated plants in the state of Bahia, Brazil, most of the information having already been noticed from other papers by the author.

JACQUES (C.). **Maladie des cocotiers.**—*Rev. agric. Nouv. Calédonie*, 1930, pp. 29–36. Nouméa, February 1930.

In reply to a letter describing injury to coconut trees in New Caledonia, the author states that the damage is due to a weevil, probably *Rhynchophorus ferrugineus*, F., and that the only method of control is to destroy infested trees, to eradicate all banana plants (in the decaying trunks of which both larvae and adults of *R. ferrugineus* may be found) and to practise clean cultivation. A report written by the author to the Governor in 1928 is appended in which he describes the injury and points out the advisability of legislation to enforce measures of control.

ESAKI (T.) & HASHIMOTO (S.). **Report on the Leaf-hoppers injurious to the Rice Plant and their natural Enemies.** [*In Japanese.*]—*Publ. Kyushu Imp. Univ. Dept. Agric.*, no. 1 (1929), 30 pp. Fukuoka, March 1930.

In 1929, 14 species of Homoptera were collected in rice-fields near Fukuoka. The four species mentioned below, each of which probably has five generations a year, are the most important. *Nephotettix apicalis* var. *cincticeps*, Uhl., hibernates in the nymphal stage among grasses, the adults appearing in April. The average numbers of eggs laid by females of the first, third and fifth generations were 321, 92 and 228 respectively. They hatch in 6–11 days, and the adults mature about three weeks later. The maximum life is 79 days for females, and 34 for males. *Deltocephala dorsalis*, Motsch., probably hibernates in the egg stage; the adults appear in May. The males live up to 20 days and the females, which lay about 170 eggs, up to 35. The nymphal stage lasts 2–5 weeks. The adults of *Delphacodes* (*Liburnia*) *striatella*, Fall., appear in April. Males and females may live as long as 8 and 10 weeks respectively. The average numbers of eggs laid are 250 in summer, and 180 in spring and autumn. They hatch in 5–11 days, and the adult stage is reached 2–6 weeks later. Females of *Sogata* (*L.*) *furcifera*, Horv., lived up to 64 days and males up to 38. The average numbers of eggs laid by females of the second, third and fourth generations were 151, 284 and 366 respectively. The egg stage lasts 7–10 days, and the nymphal stage 14–26. *Pseudogonatopus* sp.,

Haplogonatopus sp., and *Echthrodelphax* sp. are parasitic in these leaf-hoppers, and a Mermithid attacks *S. furcifera*, over 40 per cent. being sometimes infested.

MATSUMOTO (S.) & SAITO (T.). **Studies on** *Onychiurus* **injurious to Wheat Shoots.** [*In Japanese.*]—*Extra Rep. Okayama Agric. Expt. Sta.*, no. 35, 44 pp., 6 pls. Okayama, 1930.

In Japan, three species of Collembola, *Onychiurus yagii*, Kinoshita, *O. matsumotoi*, Kinoshita, and *O. watanabei*, sp. n., descriptions of which are given, damage the shoots of wheat. *O. yagii*, which is widely distributed and very injurious, has one generation a year, the eggs being laid in masses of 12–35 from January to April, in crevices in the ground, or on the seeds or dead shoots of wheat. The egg stage varies from 20 to 60 days according to temperature. The adults and larvae become inactive and remain dormant in the ground from May until October. The larval stage lasts several months, and the adults may live for more than 10 months. One female was observed to moult 18 times, some moults occurring after oviposition. *O. matsumotoi* lays its eggs from November to May in masses of 2–17, the eggs hatching in 26–91 days. *O. watanabei* oviposits in winter and spring. The eggs, which occur in masses of 5–10, hatch in 24–42 days. Aestivation also occurs in both these species.

TAKAHASHI (R.). **Migration of Japanese Aphididae.** [*In Japanese.*]—*Kontyû*, iv, no. 1, pp. 45–50. Tokyo, April 1930.

A list is given of the known summer and winter food-plants of Japanese Aphids that have the habit of migration, with notes on some of the species. *Pemphigella aedificator*, Buckt., which is found in galls on *Pistacia* in India, has been collected on *Oplismenus* in Formosa. *Eriosoma clematicola*, Tak., which infests the stalks of *Clematis fouriana* in Formosa, sometimes producing galls, has been found in galls on the leaves of *Zelkova* in Korea.

ARAKAWA (Y.). **The Life-history of** *Galeruca banghaasi*, **Weise (2).** [*In Japanese.*]—*Insect Wld.*, xxxiv, pp. 110–114. Gifu, 1930.

In these continued studies on the bionomics of *Galeruca banghaasi*, Weise, in Manchuria [*cf. R.A.E.*, A, xviii, 244], the eggs were found to survive extreme cold. The egg stage, in which the winter is passed, lasts 206–232 days, the larval stage a month, and the pupal stage 4–7 days.

HARADA (T.). **On the Insects injurious to Hemp, especially** *Rhinoncus pericarpius*, **L.** [*In Japanese.*]—*Insect Wld.*, xxxiv, pp. 118–123. Gifu, 1930.

A list is given of the 29 species of insects known to attack hemp in Japan, of which the weevil, *Rhinoncus pericarpius*, L., is very injurious. It has one generation a year, hibernation taking place in the adult stage. The eggs are laid in the young stalks, oviposition beginning in the first week of May, and hatch within a week. The

larval and pupal stages each last three weeks, pupation occurring in the soil. The weevils feed on the young leaves and stalks, but the chief injury is due to oviposition, which produces galls in the stalks.

UENO (T.). *Sideridis unipuncta*, **Haw., occurring in large Numbers in Wakayama-Ken.** [*In Japanese.*]—*Insect Wld.*, xxxiv, pp. 154–162. Gifu, 1930.

An outbreak of the Noctuid, *Cirphis* (*Sideridis*) *unipuncta*, Haw., occurred over the greater part of Japan in 1929, serious damage being caused to Italian millet [*Setaria italica*] and other cereals, and to sweet potato.

YUASA (H.). **Two new species of Eumolpid Beetles noxious to the Mulberry-tree in the Liu-Liu [Loochoo] Islands.**—*Proc. Imp. Acad.*, vi, no. 7, pp. 293–295, 2 figs. Tokyo, July 1930.

The Eumolpids, *Rhyparida sakisimensis*, sp. n., and *Abirus yashiroi*, sp. n., are recorded from the Loochoo Islands, the adults of both feeding on the leaves and young buds of mulberry. Nothing is known of the early stages of the former, which occurs only in the Sakisima group of the Islands. The latter, found only in Okinawa Island, has probably only one generation a year. The eggs are laid in cracks in the bark and at the tips of dead branches. As soon as they hatch, the larvae appear to enter the soil and hibernate. The adults emerge in April or May and live until June.

MILLER (N. C. E.) & PAGDEN (H. T.). **Preliminary Observations on** *Sogata* **spp. Pests of Padi.**—*Malayan Agric. J.*, xviii, no. 5, pp. 238–241, 4 refs. Kuala Lumpur, May 1930.

Outbreaks of *Sogata* sp. on rice were recorded from two districts in Malaya in 1929. From the material available, the authors were unable to decide whether the species concerned was *S. pallescens*, Dist., or *S. distincta*, Dist. They suggest that both these may prove to be synonymous with *S. furcifera*, Horv. [which is the view already adopted by F. Muir]. As in the case of the first record of these Delphacids [*R.A.E.*, A, xiv, 557], they disappeared suddenly before control measures could be put into operation. It has been noticed in India that continuous rains are favourable to the development of *Sogata*, but in one of the infested districts in Malaya heavy rain during an outbreak caused its disappearance. The degree of humidity seems to be the determining factor in regard to the duration of an outbreak, and severe infestation has never been observed in dry areas. Egg masses brought into the laboratory have been found to be infested by mites, which possibly destroy the eggs. Eggs laid in the laboratory on 8th January 1930 produced nymphs on 13th and adults on 27th. The processes of oviposition and hatching are described. Shortly after hatching the nymphs begin to feed on the leaf lamina ; the later nymphal instars frequently feed lower down on the plants, attacking the leaf sheath. They are inclined to feed higher up on the plant in the early morning and to descend as the sun becomes more powerful. The insect exudes small drops of clear fluid while feeding, which is said to provide a suitable medium for the development of fungi. The site of oviposition is indicated by reddish-brown patches on the leaves,

usually on the convex surface. Running off the water from attacked areas if practicable is an efficient method of control. The use of large drag-nets has proved ineffective, as the insects jump downwards when the plants on which they are feeding are disturbed, and the nets are liable to break the plants.

KING (C. B. R.). **Report of the Entomologist [for 1929].**—*Bull. Tea Res. Inst. Ceylon*, no. 4, p. 29. Kandy, 1930.

The insects recorded as attacking tea in Ceylon have been already noticed in previous reports [*R.A.E.*, A, xvi, 687 ; xvii, 414]. *Crotalaria* was attacked by *Argina argus*, Koll.

Experiments in breeding *Trichogramma erosicornis*, Westw., an egg parasite of the tea tortrix [*Homona coffearia*, Nietn.], have been continued during the year and have proved successful. The ratio of parasites emerged to those used for parasitism improved steadily towards the end of the year, and showed that there would probably be no difficulty in maintaining a ratio of about 15 : 1. Eggs of *Corcyra cephalonica*, Staint., were found to be more suitable than those of *Sitotroga cerealella*, Ol., for breeding the parasites, since they are larger and do not stick together like those of *Sitotroga*. Parasites reared from eggs of the latter are uniformly smaller than those reared from eggs of *H. coffearia*, while those bred from eggs of *C. cephalonica* are almost normal in size.

[HUTSON (J. C.).] **Half-Yearly Report of the Entomological Division, Department of Agriculture, Ceylon. January to June, 1930.**—Folio, 2 pp. typescript. [Peradeniya, 1930.]

New food-plant records are given for species of *Calotermes* and *Coptotermes* attacking tea in Ceylon. The results of treating over 200,000 tea bushes with Paris green against termites [*R.A.E.*, A, xviii, 105] have been entirely successful. Recent investigations have shown that rubber (*Hevea brasiliensis*) is seriously injured by *Calotermes* (*Neotermes*) *greeni*, Desn., *C.* (*Glyptotermes*) *ceylonicus*, Holmgr., and *C.* (*G.*) *dilatatus*, Bugnion & Popoff. These termites gain entrance to the heartwood through the decayed ends of broken branches and diseased patches of bark, particularly those affected by *Ustulina*. In view of the serious status of *Coptotermes gestroi*, Wasm., in other countries [*cf.* xvii, 170], the discovery of a local species of the genus, *C. ceylonicus*, Holmgr., attacking *Hevea* is regarded with apprehension.

Young plantations of *Artocarpus integrifolia* were seriously defoliated by larvae of the Bombycid, *Ocinara varians*, Wlk. The outbreak was controlled to a certain extent by large numbers of mynah birds (*Acridotheres tristis melanosternus*), which fed on the caterpillars, and by the predacious Pentatomid, *Cantheconidea* (*Canthecona*) *robusta*, Dist. *Laccifer* (*Tachardia*) *albizziae*, Green, which yields the local lac, caused severe injury to young plantations of *Filicium decipiens*. Kapok (*Eriodendron anfractuosum*) was seriously damaged by the weevil, *Alcides affaber*, Boh., which does not appear to have been previously recorded from Ceylon. The adults feed on the leaf-stalks, causing them to droop, and the tunnelling of the larvae in the leading shoots produces deformation of the tree. *Hydnocarpus wightiana* was attacked by the larvae of the Tineid, *Pronomeuta sarcopis*, Meyr., and the Nymphalid, *Cirrochroa thais lanka*, Moore, and by *Pinnaspis* (*Hemichionaspis*)

theae, Mask. *Cinchona calisaya* was damaged by *Coccus viridis*, Green.

Large tracts of land have been cleared of prickly-pear (*Opuntia dillenii*) by *Dactylopius opuntiae*, Ckll. (*tomentosus*, auct.), which was introduced in 1924 [xv, 100], and the experiment has proved an unqualified success.

LESTER-SMITH (W. C.). **Half-Yearly Report, January to June 1930, of the Central Plant Pests and Diseases Inspectorate** [Ceylon Department of Agriculture].—Folio, 7 pp. typescript. [Peradeniya, 1930.]

Notes are given on the more important insects in the central district of Ceylon that are declared pests under the Plant Protection Ordinance, No. 10 of 1924 [*R.A.E.*, A, xiii, 72 ; xvi, 447], showing their present status and giving a brief outline of the legislation concerning each. Short notes are also given on minor pests in the same area.

DE MEL (C. N. E. J.). **Half-Yearly Report, January to June 1930, of the Southern Plant Pests and Diseases Inspectorate** [Ceylon Department of Agriculture].—Folio, 2 pp. typescript. [Peradeniya, 1930.]

Brief notes are given on the incidence of a number of insect pests occurring in the southern district of Ceylon, among the less usual being *Pinnaspis* (*Chionaspis*) *theae*, Mask., on tea, and *Disphinctus humeralis*, Wlk., and *Ferrisia* (*Pseudococcus*) *virgata*, Ckll., on betel (*Piper betle*).

D'EMMEREZ DE CHARMOY (D.). **[Insect Pests in Mauritius in 1928.]**—*Ann. Rep. Dept. Agric. Mauritius, 1928*, pp. 6–8. Mauritius, 1929. [Recd. 1930.]

Pests occurring on sugar-cane in Mauritius in 1928 were *Sesamia vuteria*, Stoll (pink borer), *Diatraea venosata*, Wlk. (*sacchariphaga*, Bojer) (spotted borer), *Rhizotrogus pallens*, Arrow, the larvae of which destroyed all the cane stools over an area of about 2 acres, but were controlled with calcium cyanide followed by ploughing, and *Chionaspis tegalensis*, Zehnt., in the coastal belt. The situation with regard to *Lachnosterna* (*Phytalus*) *smithi*, Arrow, has been reported on elsewhere [*R.A.E.*, A, xviii, 140, 141] ; the parasite, *Tiphia parallela*, Smith, was distributed in all localities where it is not yet established and where the pest is prevalent. Other pests, besides some of those mentioned in the previous report [xvii, 100], included a mole-cricket (*Gryllotalpa*) damaging tobacco seedbeds ; *Brontispa* (*Xiphispa*) *limbata*, Waterh., on young palms ; *Thrips tabaci*, Lind., on onions ; *Icerya seychellarum*, Westw., which attacks various trees and against which the predacious Coccinellid, *Novius* (*Vedalia*) *chermesina*, Muls., has been liberated from rearings in the laboratory ; the Tineid, *Elachista* sp., on sweet potato ; the Aphids, *Macrosiphum picridis*, F., on artichoke, and *Aphis tavaresi*, Del G., on *Citrus* ; *Solenopsis geminata*, F., which was troublesome in seed-beds, particularly of tobacco, but was controlled by applications of calcium cyanide ; and the Pyralid, *Crambus seychellelus*, Fletcher, on lawns, against which a solution of calcium cyanide, 1 : 500, gave the best results.

Taylor (J. S.). **Notes on some South African Lepidoptera.**—*Ent. Rec.*, xlii, no. 9, pp. 122–123. London, September 1930.

The following notes made during the last two years in the Eastern Transvaal are, in some cases, supplementary to those already noticed [*R.A.E.*, A, xvi, 62]. The adult of *Cosmophila auragoides*, Hb., is on the wing during the day, and the eggs are deposited singly on the leaves of cotton. The larval and pupal periods last 15–18 and 11–12 days, respectively, in March, but are somewhat shorter in summer. The Tachinid, *Sericophoromyia marshalli*, Villen., has been obtained from the larva. *Tarache nitidula*, F., also feeds on cotton leaves, occasionally making a small puncture in a boll. A gravid female taken in the field deposited 741 eggs over a period of 7 days. Oviposition takes place at night, the eggs being laid singly. During March, the larvae hatch in 5–6 days and pupate 25–31 days later in tough cocoons on the surface of the soil. Hibernation occurs in the pupal stage, adults emerging during October and November. The pupal period varies from 168 to 203 days. The larva of *Anomis sabulifera*, Guen., has been found on cotton leaves. Pupation takes place in a loose cocoon in the soil, the adults emerging 13–15 days later during March. A Tachinid has been obtained from the larva. *Eublemma brachygonia*, Hmpsn., feeds on the bracts of cotton flowers and pupates among the bracts. The adult emerges during March after a pupal period of 20 days.

Cirphis leucosticha, Hmpsn., occurs commonly on the tassels of maize before they ripen and while partly protected by the sheathing leaves. It is usual to find several larvae feeding on one tassel. Pupation takes place in the soil, the adult emerging 24 days later (October to December). Two Tachinids and a Sarcophagid have been obtained from the larva. A larva of *Sphingomorpha chlorea*, Cram., which is one of the commonest fruit-sucking moths [*R.A.E.*, A, xvii, 351], was found feeding on the foliage of *Sclerocarya caffra*. The Geometrid, *Xanthorhoë exorista*, Prout, attacks the leaves of carrots, sometimes in large numbers. Pupation takes place in the soil, the adults, during April, emerging 2 weeks later. The adults of the Saturniid, *Nudaurelia zambesina* subsp. *ringleri*, Wichgrf., appear towards the end of October and the larvae, which are full-grown about the end of March, have been found feeding on plum foliage. Pupation takes place in the soil, the pupal stage lasting about 7 months. Larvae of *Lampides* (*Lycaena*) *baetica*, L., have been observed boring into and feeding on the contents of pea pods.

Lean (O. B.). **Experiments on the Life History and Control of the Yam Beetle in the Benue Province of Nigeria.**—*8th Ann. Bull. Agric. Dept. Nigeria, 1929*, pp. 43–57, 3 refs. Lagos, 1929. [Recd. 1930.]

Observations on the Dynastid, *Heteroligus claudius*, Klug, which feeds on yam tubers in Nigeria, were continued during 1928 [*R.A.E.*, A, xvii, 298]. It has been found that the beetles of the small type observed towards the end of the season [xvii, 299] belong to a distinct species of *Heteroligus*. The beetles were far less numerous than in the previous year in the area examined, and there seemed to be a general movement westward. Apparently the pest is serious in any district for a few years only and then moves on. An extensive breeding-ground

of *H. claudius* was discovered along the Niger and some of its tributaries ; there is probably considerable migration of adults from the breeding-grounds, and as the larvae are not confined to the yam fields no control of this stage in these areas is possible by agricultural methods. Larvae were found attacking grass roots and on one farm killed about 70 per cent. of the seedlings of ground-nuts [*Arachis hypogaea*] ; they also destroyed maize seedlings growing among yams. The larval habitat elsewhere is probably restricted to localities where moisture conditions are suitable through the dry season. The method of destroying larvae and pupae by scattering the old yam heaps and thus exposing them to the sun [xvii, 299] was tried on a fairly large scale. The indications were that damage was reduced by about 24 per cent., but owing to the general decrease of beetles in the areas dealt with, the experiment must be regarded as inconclusive, though it will be continued, and it is thought that the full benefits may not be marked until the second season. Farmers were quite willing to adopt this method, but there was some difference of opinion regarding its effect on the subsequent crop of gero [*Pennisetum typhoideum*]. Light traps were of no value, and lemon grass (*Cymbopogon* sp.) was grown with yams as a deterrent but without success.

Menozzi (C.). **Insetti dannosi alla barbabietola osservati durante la campagna 1929. (Osservazioni ed appunti preliminari.)** [Insect Pests of Sugar-beet observed during the Season 1929 in Italy. Preliminary Observations and Notes.]—*Indust. saccarif. ital.*, xxiii, nos. 1, 2, 4, reprints 24, 19 & 28 pp., 13 pls. Genoa, January, February, April 1930.

The four major pests observed, which are dealt with in considerable detail, were *Conorrhynchus* (*Cleonus*) *mendicus*, Gyll., *Cassida vittata*, Villers, *Lixus junci*, Boh., and *Chaetocnema tibialis*, Ill. The egg, larva and adult of the first three and the adult of *C. tibialis* are described. They all hibernate in the adult stage in sheltered situations.

The adults of *Conorrhynchus mendicus*, which fly little if at all, appeared at the end of March. In July all stages occurred together. The eggs are deposited from the end of May until early September, at the rate of 60–70 per female. They are laid singly round the collar of the beet and hatch in 5–8 days. The larvae attack the roots and pupate in the soil, the larval stage lasting about two months. The first new adults occurred in mid-August. When the beets are harvested, many pupae and larvae about to pupate are destroyed. A compact, clay soil is preferred, sandy areas being almost always free from infestation. The chief injury by the adult is to the tender leaves first put out, but adult feeding is continuous in spring and summer. The larvae caused a crop loss of up to 60 per cent. The adult weevils are parasitised by *Rondania dimidiata*, Mg. [*R.A.E.*, A, xvii, 633]. The larvae occur early in May, and the adults in late May and June. This Tachinid also attacks two other weevils, *Brachycerus undatus*, F., the larva of which feeds on Liliaceae including cultivated garlic, and *Larinus cynarae*, F., the larva of which infests artichoke, etc. Other natural enemies of *C. mendicus*, which were, however, of little importance, were a Carabid, *Pterostichus melas* var. *italicus*, Dej., and an ant, *Tapinoma erraticum*, Latr., which prey on the larvae, and a fungus, probably *Beauveria globulifera*, which kills the larvae, pupae and adults.

The measures suggested are crop rotation ; early sowing ; postponement of thinning as late as possible ; hand collection of the adults ; spraying with 4 per cent. barium chloride, which is only effective in warm, sunny weather at about 21° C. [69·8° F.] ; treating the rows round the edge of the field, which should be sown densely, with 1 per cent. colloidal lead arsenate to protect the plants in the centre until the temperature becomes sufficiently high to ensure good results with barium chloride ; and driving in turkeys, especially at harvest time.

The adults of *Cassida vittata* appeared in the second half of April and oviposited soon afterwards. Each female lays 20–30 eggs on the leaves over a period of 15–20 days. The larvae feed and pupate on the leaves, the pupal stage lasting 6–8 days and the total cycle of the first generation 36–40. In 1929, three overlapping generations occurred in Central Italy from April to September. In a very hot year four are possible, while in North Italy two occur normally. This beetle is less injurious than *Conorrhynchus*, but may do serious damage and was responsible in one case for a crop loss of 50 per cent. The larvae are parasitised by *Tetrastichus bruzzonis*, Masi, *Brachymeria vitripennis*, Först., and *Habrocytus* sp., but the last-named is of little importance. *Trichogramma evanescens*, Westw., was bred from the eggs. The measures advised are spraying with 1 per cent. colloidal lead arsenate as soon as the beetles appear, the spray being repeated two or three times while the leaves are still growing vertically ; collection of the adults with a net ; and spraying the winter quarters at the foot of various plants with oil emulsion in October and November.

Lixus junci is a polyphagous weevil that attacks cabbage, beans, etc., as well as Chenopodiaceae, and the adults spread by flight. Oviposition occurs in the second half of May, each female laying about 30 eggs, on the mid-rib or on the aerial part of the root when the latter is about $\frac{1}{8}$ inch in diameter. The larva, which hatches in 8–10 days in April and May, feeds in the mid-rib and, especially during drought, bores down into the root. The larval stage lasts 35–40 days, and the pupal stage, which occurs in the mine, about a fortnight. The larvae are parasitised by *Microbracon* (*Bracon*) *intercessor*, Nees, which infested 72–78 per cent. in one area, two species of *Eurytoma*, *Perilampus italicus*, F., *Picroscytoides cerasiops*, Masi (which may, however, possibly be a hyperparasite attacking *M. intercessor* or *Eurytoma*), and a Tachinid, *Zeuxia cinerea*, Mg. The eggs are attacked by a Pteromalid, possibly *Habrocytus lixi*, Sarra [xii, 513]. Control is difficult, but hand collection from the various food-plants and spraying the latter with 1 per cent. lead arsenate may be of some value. At harvest, the root-collars and leaves should be cleared away at once, as they contain pupae and adults.

The Halticid, *Chaetocnema tibialis*, which attacks a variety of plants, though beet is preferred, destroys the leaves. Young plants are killed, and older ones fail to develop normal roots. The beetles may be caught on cloths smeared with adhesive and dragged through the fields so that the unsmeared side brushes the plants, and naphthalene may be used as a repellent.

The following minor pests are also recorded, notes on control being given in many cases : *Subcoccinella vigintiquatuorpunctata*, L., *Cebrio* sp., *Agriotes litigiosus*, Rossi, *Epicauta erythrocephala*, Pall., *Dasus* (*Gonocephalum*) *pusillus*, F., *Phyllotreta atra*, F., *Longitarsus pellucidus*, Foudr., *Hypocassida subferruginea*, Schr., *Cassida vibex*, L., *C. deflorata*, Suffr., *Sitona humeralis*, Steph., *S. lineata*, L., *Tanymecus palliatus*, F.,

Leucosomus pedestris, Poda, *Conorrhynchus luigionii*, Sol., *Mecaspis caesus*, Gyll., *Chromoderus fasciatus*, Müll., *Cyphocleonus tigrinus*, Panz., *Lixus scabricollis*, Boh., *L. sanguineus*, Rossi, *Pentodon punctatus*, Villers, the sawfly, *Athalia colibri*, Christ, *Euxoa* (*Agrotis*) *segetum*, Schiff., *Phthorimaea ocellatella*, Boyd, *Pegomyia hyoscyami*, Panz., *Calocoris norvegicus*, Gmel., *Piesma quadrata*, Fieb., *Hysteropterum grylloides*, F., *Empoasca* (*Chlorita*) *flavescens*, F., and *Aphis rumicis*, L.

v. Finck (I.). **Harzlösung als Mittel gegen die parasitären Rindenkrankheiten der Bäume und Sträucher, insbesondere gegen Blutlaus und Harzfluss.** [A Solution of Resin as a Remedy against parasitic Bark Diseases of Trees and Bushes, particularly Woolly Aphis and Exudation of Resin.]—*Die kranke Pflanze*, vii, no. 5–6, pp. 74–75. Dresden, 1930.

A 25–30 per cent. solution of pine or spruce resin in methylated spirit is stated to be an excellent remedy against the woolly apple aphis [*Eriosoma lanigerum*, Hausm.] and the flow of resin due to fungus attack. The solution is brushed over the bark and into the cracks. It is obtainable commercially.

Douence (A.). **Les appâts empoisonnés. Leur utilisation dans la lutte contre les ennemis des cultures.**—*Ann. Epiphyties*, xv, no. 1–2, pp. 1–96, 8 pp. refs. Paris, December 1929. [Recd. 1930.]

This is a general and comprehensive review from the literature of the use of poison baits against pests of crops and includes an account of the insect pests against which this method may be successfully employed. The necessity for a study of their biological characteristics and of adapting the bait to the diet of the pest concerned is pointed out, and an account is given of the various toxic substances and attractants hitherto employed. The insects are then dealt with in greater detail under their orders, and formulae for baits that have proved successful in controlling them are given. The advantages and dangers of poison baits are discussed, and the legal restrictions to which their use is subject in France are recapitulated. The author believes that this method of insect control is capable of improvement and further development, and considers its importance to be comparable with that of biological, chemical and cultural methods.

Marchal (P.). **Les ennemis du puceron lanigère, conditions biologiques et cosmiques de sa multiplication.—Traitements.**—*Ann. Epiphyties*, xv, no. 3, pp. 125–181, 3 pls., 10 figs., 54 refs. Paris, December 1929. [Recd. 1930.]

A considerable part of this paper on the enemies of *Eriosoma lanigerum*, Hausm., which is the continuation of a study on its biology and morphology [*R.A.E.*, A, xvii, 118], is devoted to an account, chiefly taken from the literature, of *Aphelinus mali*, Hald., its introduction from North America in 1920 and 1921 [ix, 593], and its subsequent spread and distribution in France up to 1928, with brief records of its introduction and progress in various parts of the world and notes on its biology [*cf.* xiii, 177]. According to observations and

experiments in France, *A. mali* rarely attacks any other host than *E. lanigerum*, and then only closely allied species of *Eriosoma*, and the author suggests that records of it from other Aphids are due to misidentification.

Notes based on observations carried out near Paris over a period of 15 years are given on the predacious enemies of *E. lanigerum*, the most important of which are Syrphids, Coccinellids and Hemerobiids. The extent to which they hold the Aphid in check has been demonstrated by field tests in which it persisted in large numbers on caged trees, whereas it completely disappeared on adjacent ones to which the predators had access. Drought and birds are minor accessory factors in the control of the Aphid. It was observed that ants in attendance upon *Aphis pomi*, DeG., hindered the action of predators upon *Eriosoma*. Syrphids observed as playing an important part in the control of *E. lanigerum* include *Syrphus balteatus*, DeG., and *S. ribesii*, L. A Chalcid, *Pachyneuron formosum*, Wlk., was obtained from the pupae of *S. balteatus*, 8–12 parasites emerging from each parasitised pupa. An Ichneumonid has also been reared from pupae of Syrphids collected from branches that had been previously covered with *E. lanigerum*, but the enemies of these flies are not usually sufficiently numerous to prevent them from controlling the latter. The most important Coccinellid predacious on *E. lanigerum* is *Exochomus quadripustulatus*, L., which also feeds on Diaspine Coccids. The pupae are often parasitised by the Eulophid, *Lygellus epilachnae*, Giard. The parasites hibernate in the larval stage in the host pupa, and the adults emerge in the following June to oviposit in the mature larvae and probably also in the early pupae, from which the second generation emerges in July and attacks the pupae. *E. lanigerum* is also attacked by *Coccinella septempunctata*, L., *Adalia bipunctata*, L., and *Chilocorus bipustulatus*, L., although the latter prefers certain Diaspine Coccids often found together with the Aphid on the bark of apple trees. Coccinellids predacious on it in other countries are cited from the literature.

Hemerobiids observed to prey upon *E. lanigerum* include *Chrysopa septempunctata*, Wesm., *C. vulgaris*, Schneider, and *C. walkeri*, McLachl. Observations over a number of years indicate that they contribute largely to its control, particularly when it reaches its maximum in the second half of July. Their advent is indicated by the presence on infested apple trees of eggs suspended from the lower surface of the leaves by long threads. One female of *C. septempunctata*, taken from an infested apple tree on 28th July 1925, lived for 8 days and laid 132 eggs. These began to hatch 8–9 days later. Among numerous predacious Rhynchota, the most important is *Deraeocoris ruber*, L. (*Capsus capillaris*, F.), which was abundant in 1924 on trees attacked by *Eriosoma*. A Trombidiid, *Allothrombium fuliginosum*, Herm., destroys the Aphids hibernating in the cracks of the bark early in the season, and a second generation appears later in the year among the colonies.

The fungous parasites and symbionts of *E. lanigerum*, the physiological and economic significance of which is still undefined, the effect of temperature and humidity on it, and resistant and susceptible varieties of apple are briefly discussed. Other food-plants on which the Aphid has been found in France are *Pyrus japonica* (Japanese quince) and certain species of *Cotoneaster*. The various insecticides used in the control of *E. lanigerum* during the past 50 years in all parts of the world are reviewed from the literature.

ZOLOTAREVSKY (B. N.). **Le criquet migrateur** (*Locusta migratoria capito* **Sauss.) à Madagascar.**—*Ann. Epiphyties*, xv (1929), no. 4, pp. 185–236, 2 pls., 1 map, 8 figs., 30 refs. Paris, May 1930.

The history of locust outbreaks in Madagascar is reviewed ; swarms were present in some parts of the Island annually from 1901 to 1906 and from 1909 to 1915. The last great outbreak started in the southern districts in 1923, and during the succeeding years the locusts gradually moved northward, until in 1927 the whole of the Island was invaded.

The form of *Locusta migratoria*, L., inhabiting Madagascar possesses certain fixed peculiarities distinguishing it from those inhabiting the surrounding islands and the African Continent. The author gives tables demonstrating the differences between the African and Madagascar forms, and considers the latter a distinct subspecies, *Locusta migratoria capito*, Sauss. Descriptions and figures are given of the phases *solitaria, gregaria, transiens, dissocians* and *congregans*, with detailed comparative accounts of the characteristic behaviour of each of these phases. The migrating locusts oviposit in any kind of soil if it is sufficiently soft to be penetrated by the female, showing a preference for ground with scanty vegetation ; oviposition usually occurs on hills above the reach of floods.

From a survey of the ecological conditions in various parts of the Island, the author concludes that the true breeding grounds, where the species permanently exists and from which it migrates in years of mass outbreaks, are to be found in the southern districts. There, at the beginning of the dry season, the locusts are forced to concentrate in small areas of fresh grass growing in the more humid depressions of the ground ; the solitary locusts of the following generation oviposit in these restricted areas, and this concentration of egg-pods may lead to the production of the phase *congregans*, and then of the phase *gregaria*. If, as is probable, a diapause can occur in the egg-stage of this locust, the concentration would be further increased by successive ovipositions during the dry season and simultaneous hatching of eggs after the first rains. The Island may be divided into four regions, *viz.*, the zone of permanent breeding grounds, south of the Onilahy River ; the first emigration and swarming zone on the plateaux of the south-west and west ; the second emigration zone on the plateaux of the western side of the central massif ; and the zone which is occasionally visited in the mountain region of the centre and wooded regions of the east.

The routes followed by the swarms in their general movement are described [*cf. R.A.E.*, A, xvii, 538], and arguments are advanced against the theory that locusts invading Madagascar originate on the African Continent.

GAUMONT (L.). **Conditions générales de pullulation des Aphides.**—*Ann. Epiphyties*, xv, no. 5, pp. 253–316, 18 figs., numerous refs. Paris, June 1930.

The author has made a detailed study of Aphids in France and of the general factors regulating their reproduction and abundance. He discusses the climatic conditions, which, acting regularly and periodically, have determined various adaptations and modifications of the life-cycle, the food-plants of a large number of species, explaining

their distribution on different parts of the plants, and conditions of commensalism, particularly between Aphids and ants.

Other factors act intermittently and irregularly on the different generations, the most important of these being predators and parasites. The value of several species of Syrphids as predators of Aphids has previously been discussed [*R.A.E.*, A, xvii, 409]; their importance is unfortunately limited by a number of Hymenopterous parasites, of which a list is given. Certain Aphidiine Braconids, such as *Aphidius*, *Ephedrus* and *Praon*, are valuable parasites and sometimes destroy large colonies of Aphids, but are themselves killed by hyperparasites, of which the commonest are *Allotria* spp. About the end of April, when the APHIDINAE are present in their greatest numbers, Coccinellids begin to appear as valuable predators; they are at the height of their activities in July, but gradually die off towards the winter as a result of the work of insect enemies and birds. In each season these factors interact differently, sometimes favouring and sometimes limiting Aphid abundance.

JAMES (H. C.). **Repellent Banding to control the Ants attending the Common Coffee Mealy-bug.**—Roy. 8vo, ii+14 pp., 3 figs. Nairobi, Dept. Agric., Kenya, 1930.

Repellent banding against *Pheidole punctulata*, Mayr, as an indirect means of controlling the common coffee mealybug [*Pseudococcus lilacinus*, Ckll.] in Kenya is discussed in greater detail than in the report already noticed [*cf.* *R.A.E.*, A, xvi, 310]. The author points out that as the high boiling-point tar oil, which has proved the most effective repellent [*loc. cit.*] is known commercially as "cresoto," it has often been confused with creosote, a substance that is only effective as an ant repellent for a very short time and is much more injurious to the trees. He therefore adopts the spelling "kresotow," in the hope that this will come into general use. When satisfactory kresotow is not procurable, a mixture of castor oil with mercury bichloride, applied on the under surface of paper cones, should be used. It is prepared by shaking up ½ oz. mercury bichloride in a little methylated spirit until the crystals are resolved into a fine precipitate, and adding this mixture to 3 oz. resin melted in 7½ oz. castor oil, while the latter is still warm but not hot. Bands treated with this mixture will require renewal after about 10 weeks, but two applications should be sufficient in a normal year. Adhesive preparations are more effective than any others and usually act for a longer period, but they destroy a number of beneficial insects.

Banding should be undertaken sufficiently early to save the flowers of the main crop. Where flowerings during the short rains are very small, it is probably uneconomical to band for them, especially as the bands would require renewal before flowerings in the long rains. When only a part of a plantation is banded, the untreated areas should be kept under close observation, as the ants and mealybugs may migrate from the banded trees.

Details are given of the methods of preparing and applying the bands, with an estimate of the cost in each case. The use of metal cones is discussed. These have proved effective when efficiently applied, but it is difficult to teach natives to adjust them, and the initial cost is relatively high.

GOODEY (T.). **On a remarkable new Nematode,** *Tylenchinema oscinellae* **gen. et sp. n., parasitic on the Frit-fly,** *Oscinella frit* **L., attacking Oats.**—*Phil. Trans. R. Soc.*, (B) ccxviii, pp. 315–343, 5 pls., 1 fig., 11 refs. London, 28th June 1930.

Tylenchinema oscinellae, gen. et sp. n., is widely distributed in England and Wales as a parasite of *Oscinella frit*, L. A brief outline of the life-history of the fly on oats and wild grasses is given [*cf. R.A.E.*, A, xii, 284, etc.]. Ensheathed larvae and young adults of both sexes of the Nematode were found in oat stems attacked by *Oscinella*; they were present only in the débris surrounding the larvae of the fly. The male worms die after fertilising the females, one or more of which enter the fly larva, probably through the skin. The worm remains within the host throughout its metamorphoses, becoming parasitic in the abdominal cavity of the fly. It then produces large numbers of larval Nematodes, which, after undergoing one or two moults, enter the intestine of the host and are voided through the anus. They find their way into the plant tissues surrounding the larvae of the fly, where they undergo two further moults before becoming adult. Parasitism of the fly generally results in sterilisation in both sexes, by preventing the development of the reproductive organs. As many as 14 per cent. of the first generation of the fly were found parasitised, and of the second generation up to 5 per cent.

PAPERS NOTICED BY TITLE ONLY.

TOUMANOFF (C.). **Les maladies des abeilles.**—Cr. 8vo, vii+267 pp., 68 figs., 5 pp. refs. Paris, Vigot Frères, 1930. Price, *Fr.* 30.

MURASE (K.). **A List of the Japanese Insects injurious to** *Diospyros kaki*. [*In Japanese.*]—*Insect Wld.*, xxxiv, pp. 87–92, 123–128. Gifu, 1930.

VEITCH (R.). **Some common Vegetable Pests.**—*Queensland Agric. J.*, xxxiii, pt. 5, pp. 311–315. Brisbane, 1st May 1930. [Extract, see *R.A.E.*, A, xvii, 458.]

COLLENETTE (C. L.). *Euproctis* [*Arctornis*] *rubricosta* **Fawcett** [a Cotton Pest in Uganda and Tanganyika, *R.A.E.*, A, xiv, 230; xvi, 65; xvii, 694], **a Synonym of** *Porthesia producta* **Wlkr.** —*Entomologist*, lxiii, no. 808, p. 211. London, September 1930.

[TARBINSKIĬ (S. P.).] **Тарбинский (С.). Contributions to the Knowledge of the Genus** *Calliptamus* **Serv. (Orthoptera, Acrididae).** [*In Russian.*]—*Bull. Acad. Sci. U.R.S.S.*, Cl. Sci. phys.-math., 1930, no. 2, pp. 177–186, 10 figs. Leningrad, 1930.

CHRISTIE (J. R.). **Notes on larval Nemas from Insects.**—*J. Parasit.*, xvi, no. 4, pp. 250–256, 8 figs. Urbana, Ill., June 1930.

GIRAULT (A. A.). **Notes on, and Descriptions of, Chalcid Wasps (Chalcididae) in the South Australian Museum** [Parts I and II].—*Rec. S. Aust. Mus.*, iii, pp. 309–338; *Trans. Roy. Soc. S. Australia*, liii, pp. 309–346. Adelaide, 1927–1929.

NOWICKI (S.). **Bemerkungen zu den europäischen Apheliniden-Gattungen (Hym., Chalc.).** [Notes on the European Genera of APHELINIDAE.]—*N. Beitr. syst. Insektenk.*, iv, nos. 13–14, 15–16, pp. 153–160, 177–181, 41 refs. Berlin, 1929–30.

MERCET (R. G.). **Afelínidos paleárticos (Hym., Chalc.). 4a nota.**—*Eos*, vi, no. 2, pp. 191–199. Madrid, 5th June 1930.

KLYVER (F. D.). **Notes on the Chermidae** [PSYLLIDAE]. **Part I. (Hemiptera : Homoptera). With introductory Note by G. F. Ferris.**—*Canad. Ent.*, lxii, no. 8, pp. 167–175, 1 pl. Orillia, Ont., August 1930.

ROBERTS (R.). **Seven new Names in the Genus** *Tiphia* **(Hymenoptera, Scoliidae).**—*Canad. Ent.*, lxii, no. 8, pp. 189–190. Orillia, Ont., August 1930.

DE AZEVEDO (A.). **Um coccideo interessante em oitiseiro** [*Moquilca tomentosa*] *Eucalymnatus chelonioides*, **Newstead** [in Brazil]. -*Correio agric.*, viii, no. 7, p. 181. Bahia, July 1930.

[ARKHANGEL'SKAYA (A.).] **Архангельская (А.). List of Coccidae collected in Hothouses of the Botanical Gardens of Moscow and Leningrad in February 1929.** [*In Russian.*]—*Morbi Plantarum*, xviii, no. 4, reprint 16 pp. Leningrad, 1929. (With a Summary in English.)

MORDVILKO (A.). *Pemphigus bursarius* **Tullgren** (*pyriformis* **Licht.**) **and its anolocyclic Forms.**—*C.R. Acad. Sci. U.R.S.S.*, Ser. A, 1930, no. 3, pp. 50–54. Leningrad, 1930.

[MORDVILKO (A.).] **Мордвилко (А.). On the Origin of Heteroecy in Plant-lice.**—*C.R. Acad. Sci. U.R.S.S.*, Ser. A, 1930, no. 3, pp. 256–260, 1 ref. Leningrad, 1930.

[MORDVILKO (A.)]. **Мордвилко (А.). Notes on Aphids. 1.** *Setaphidinae* **and a new Genus** *Brasilaphis* **Mordv.** [including *B. bondari*, sp. n., from Bahia]. **2. Genus** *Neophyllaphis* **Takah. (Callipterea). 3. A Supplement to the Article " Anolocyclic Elm Aphids Eriosomea and the Distribution of Elms during the tertiary and glacial Periods "** [including *Tetraneura takahashii*, sp. n., in Formosa].—*C.R. Acad. Sci. U.R.S.S.*, Ser. A, 1930, no. 11, pp. 277–280, 1 ref. Leningrad, 1930.

JÖHNSSEN [A.]. **Die Rolle der deutschen Coccinelliden als Blattlausvertilger.** [The Rôle of German Coccinellids as Destroyers of Aphids.]—*Mitt. deuts. Landw.-Ges.*, 1930, no. 25, reprint 1 p. Berlin, 1930. [*Cf. R.A.E.*, A, xviii, 436.]

PRELL (H.). **Zur Kenntnis von Bau und Entstehung einiger Brutbildtypen bei rindenbrütenden Borkenkäfern.** [Contribution to a Knowledge of the Structure and Origin of certain Types of Brood-galleries of SCOLYTIDAE that breed in the Bark.]—*Z. Morph. Oekol. Tiere*, xvii, no. 3, pp. 625–648, 1 ref. Berlin, 24th March 1930.

[GOLOVYANKO (Z. S.).] **Головянко (З. С.). On the distinguishing Characters of the more common Larvae of the Genus** *Anisoplia* **Serv.** [*In Russian.*]—*Sbor. Sortovo-Semenn. Upravl.*, 1929, no. 8 (16), pp. 123–132, 4 pls., 6 refs. Kiev, 1929.

OHAUS (F.). **A new** *Adoretosoma* [*citricola*, sp. n.] **(Col., Rutel.) from Malaya** [on Lemon, *Citrus limonum*].—*Ann. Mag. Nat. Hist.*, (10) vi, no. 34, p. 526, 1 fig. London, October 1930.

BARANOFF (N.). **Die Sternitenkette des Abdomens bei den Parasitären Raupenfliegen und ihre systematische Bedeutung.** [The Sternite Sequence of the Abdomen in the parasitic TACHINIDAE (*sens lat.*) and its systematic Significance.]—*Z. Parasitenk.*, ii, no. 4, pp. 506–534, 2 figs., 4 refs. Berlin, 13th May 1930.

JAMES (H. C.). **Methods for the Biological Control of the Common Coffee Mealy-bug.**—Roy. 8vo, iv+16 pp., 5 pls. Nairobi, Dept. Agric., Kenya, 1930.

In employing methods of biological control against the common coffee mealybug [*Pseudococcus lilacinus*, Ckll.] in Kenya, the destruction or exclusion from the coffee trees of ants is a necessary preliminary operation ; the best means of doing this appears to be banding [*R.A.E.*, A, xviii, 566]. It has been found feasible to collect large numbers of Coccinellids predacious on *P. lilacinus* from other plants both wild and cultivated, in a short time, provided that the necessary labour is available. A list is given of the plants on which mealybugs and consequently the predacious Coccinellids have been found. It is not desirable to begin collecting more than a month before the beetles are likely to be required in the plantation. It is suggested that these beetles should be accumulated in storage insectaries and fed on mealybugs or artificial food for liberation at the time of the principal flowerings, when the most severe infestations of *P. lilacinus* usually occur. An infestation is usually unevenly distributed, and the transference of Coccinellids from lightly infested to more heavily infested trees may be of assistance.

The breeding of one or more species of predators is also recommended, in order that a supply may be ready for immediate colonisation on small outbreaks of the mealybug so as to prevent its spread. Liberations of predators on general infestations are practically useless, because the loss of crop will already have taken place. *Chilocorus angolensis*, Crotch, is particularly suitable for breeding purposes, as it is comparatively large and therefore easy to handle, and is the most efficient predator. The adult, pupa and larva are briefly described. Instructions are given for the growing of potato sprouts on which the mealybugs are reared, and for the construction of breeding cages and trays. The methods of collecting, rearing and liberating the Coccinellids are described.

DE LÉPINEY (J.). **Contribution à l'étude du complexe biologique de** *Lymantria dispar*.—*Mém. Soc. Sci. nat. Maroc*, xxiii, 100 pp., 4 figs., numerous refs. Rabat, 15th May 1930.

The author has made a detailed study of the bionomics of *Porthetria* (*Lymantria*) *dispar*, L. (gipsy moth) as a pest of cork oak in Morocco, with special reference to the factors limiting its abundance. Much of the information has been previously noticed [*R.A.E.*, A, xvi, 314 ; xviii, 85, etc.], but further data on the life-cycle and the habits of the larvae are added. Among the beetles destroying the egg-masses is the Dermestid, *Anthrenus verbasci*, L., which is frequently associated with *Trogoderma versicolor*, Creutz., and *Tenebroides maroccanus*, Reitt., the biology of which is described and which is quite as important as *Trogoderma*. The life-cycle of the larval parasite, *Apanteles solitarius*, Ratz. (of which the author considers *A. melanoscelus*, Ratz., to be a synonym) is compared with that in America [x, 403]. In both countries the long period when suitable larvae of *Porthetria* are not available is passed as a third stage larva within the cocoon, but in Morocco a partial third generation may be completed, the adults of which die without reproducing. During 1926–29, parasitism by this species

was found to reach about 15–20 per cent., and *Meteorus pulchricornis*, Wesm., parasitised an average of 8 per cent. of the larvae. The Tachinid, *Sturmia inconspicua*, Mg., of which the life-cycle is incompletely known, is of much less importance with regard to *P. dispar*.

The interactions of the factors producing mortality of *P. dispar* and the consequences of these interactions are discussed. The author considers that in the present stage of knowledge it is impossible to define precisely the effect of any insect enemy or other factor in limiting the numbers, but he discusses certain general theories arising from his observations and from those of other workers. Although much is hoped from the successful introduction of the egg parasite, *Ooencyrtus* (*Schedius*) *kuwanae*, How., the rearing of which is described, the author considers that it will only represent one of a complex of factors limiting the numbers of *P. dispar*.

Mercet (R. G.). **Los Afelínidos de España.**—*Rev. Biol. forest. Limnol.*, Ser. B, i, no. 1, pp. 3–28 ; ii, no. 2, pp. 29–106, 16 figs. Madrid, 1929–30.

This paper is a survey of the Aphelinids of Spain. In the first part the author discusses the status of the Aphelinidae, which he regards as a separate family, comprising the subfamilies Pteroptrinae and Aphelininae and quite distinct from the Eulophidae. It might, however, be included in the Encyrtidae, which would then comprise the six subfamilies, Pteroptrinae, Aphelininae, Signiphorinae, Antheminae, Arrenophaginae, and Encyrtinae ; a key to these is given. A general account of the morphology and biology of the Aphelinids is given, and their economic importance and the methods for using them against various pests and for preparing specimens for study are briefly reviewed. The second part includes notes on the classification, distribution and hosts of the European genera and Spanish species, with keys, the former and some of the latter being described.

Thompson (W. R.). **Reaction of the Phagocytes of Arthropods to their internal Insect Parasites.**—*Nature*, cxxv, no. 3154, pp. 565–566, 5 refs. London, 12th April 1930.

A brief review is given of the literature on phagocytes, with particular reference to their action on the parasites of insects. From a summary of the data, no support is afforded for the view that the adaptation of an internal insect parasite to its host consists essentially in the development of substances destined to repel, or in structures designed to afford protection from, phagocyte attack. It has long been known that phagocytes become abundant in the pupal period of the host, during which time they migrate into and destroy the degenerating larval tissues, but there is no reason to suppose that this period is a dangerous one for internal parasites, or that they require protection to enable them to survive. The idea that phagocytes break down the tissues of the parasites they attack and that the substance of the latter is built up into the tissues of the host seems also to be contrary to the facts [*cf. R.A.E.*, A, xviii, 229, 230].

STRICKLAND (E. H.). **Phagocytosis of internal Insect Parasites.**—*Nature*, cxxvi, no. 3168, p. 95. London, 19th July 1930.

In commenting on the arguments in the preceding paper that living parasitic eggs and larvae do not form centres of attraction for the phagocytes of their insect hosts, the author considers that it may be true in the majority of cases, but that it is not an invariable rule. He refers to studies undertaken with *Gonia* spp. in Noctuid larvae [*R.A.E.*, A, xii, 51]; the rapid death of small unfed larvae of the former was due in some manner to their enclosure in a phagocytic cyst. It certainly presented an impassable barrier against their essential passage to the supra-oesophageal ganglia.

The Braconid, *Meteorus vulgaris*, Cress., was also induced to oviposit in Noctuid larvae of various instars. In the more immature hosts the eggs hatched and the larvae were not attacked by phagocytes except in the event of their death. When, however, the parasite oviposited in larvae already contracting in preparation for pupation, after three days the eggs had increased in size, but were surrounded by dense phagocytic cysts. It is possible that they had succumbed before the phagocytes were attracted to them, but their enlargement indicated that they were viable after they had entered the body cavity of the hosts.

HORI (M.). **Studies on the noteworthy Species of Plant Lice (Aphididae) in Hokkaido.** [*In Japanese.*]—*Rep. Hokkaido Agric. Expt. Sta.*, no. 23, 163 pp., 2 pls., 72 figs. Sapporo, October 1929. [Recd. 1930.]

A general account is given of the external morphology, biology, natural enemies and control of the Aphids found in Hokkaido, and 42 species of economic importance are described, with notes on their bionomics and the injury they cause. *Myzus malicolens*, sp. n., infests the lower surface of the leaves and the young shoots of apple near Sapporo. The eggs hatch at the beginning of May and winged forms appear at the end of the month, the following two or three generations migrating to an unknown summer food-plant. *Rhopalosiphum kiku*, sp. n., attacks *Chrysanthemum*, and *Anuraphis ammobii*, sp. n., is injurious to the flowers and young stalks of *Ammobium alatum*. *Anuraphis piricola*, Okam. & Takah., infests the leaves of pear. The eggs hatch at the beginning of May, and winged forms appear in June and migrate to *Artemisia vulgaris kamtschatica*, the roots of which are attacked during the summer. The autumn migrants return to pear in October. *Prociphilus kuwanai*, Monzen, occurs on pear in spring, and spends the summer on the roots of *Rumex crispus japonicus*. *Gobaishia japonica*, Mats., passes the winter on *Ulmus japonica*, and the summer on *Elasholtzia patrini*.

LOPEZ (A. W.). **Ability of mature Grubs of *Leucopholis irrorata* (Coleoptera, Melolonthidae) to survive Submergence in Water.**—*Philipp. J. Sci.*, xlii, no. 2, pp. 307–308. Manila, June 1930.

A laboratory experiment was carried out to determine whether mature grubs of *Leucopholis irrorata*, Chevr., which does considerable damage to sugar-cane in the Philippines, could be killed by submerging infested fields. Under the conditions of this experiment, which in some respects

were more severe than field ones, 25 per cent. of the larvae survived submergence for 96 hours, whereas 72·5 per cent. of the control larvae survived a 100-hour period. As the mortality in the controls was so high, all the deaths among the submerged larvae cannot be attributed to the water.

HASEMAN (L.) & SULLIVAN (K. C.). [**Miscellaneous Pests in Missouri in 1927-28.**]—*Bull. Missouri Agric. Expt. Sta.*, no. 272, pp. 57–62. Columbia, Mo., May 1929. [Recd. 1930.]

In experiments on the effect of heat on various insects that infest stored products, it was found that though the susceptibility of the species varied somewhat, all were killed by exposure to 125° F. for 24 hours, whereas 20 different kinds of seeds were not injured by 24 hours' exposure to 140° F. Carbon bisulphide, at the rate of 1 lb. to 500 cu. ft. and at a temperature of 90° F., destroyed all the insects in 24 hours, and seeds were not injured when the same amount was used to 25 cu. ft. Paradichlorobenzene, at the rate of 1 lb. to 100 cu. ft. killed all insects in 48 hours, and did not injure seeds at the rate of 1 lb. to 1 cu. ft.

Observations on the strawberry crown borer [*Tyloderma fragariae*, Riley] show that the winter is passed in the adult stage, in the débris and soil in the strawberry beds. Feeding may occur on warm days in winter. Since the adults feed to a considerable extent between mating, which takes place in March, and oviposition, spraying with 2 lb. lead arsenate to 50 U.S. gals. water or dusting with 85 lb. hydrated lime and 15 lb. lead arsenate during March and April materially reduces the damage caused. Treated plots yielded 258 more U.S. qts. of fruit to the acre than untreated ones. The beetles may live and continue to oviposit until July or August, feeding on the foliage throughout this period. Counts made in a badly infested field in the south-western district of the State revealed approximately 34,000 adults to the acre.

In tests in which the value of various dusts and sprays containing lead arsenate against insect pests of apple, particularly the codling moth [*Cydia pomonella*, L.], was compared, it was found that the dusts were just as effective and covered the foliage better than the sprays, but did not adhere so well. It may be possible to eliminate the spray residue problem by using dusts for late summer applications. In experiments on timing the applications of various sprays and dusts with the emergence periods of the spring brood of *C. pomonella*, it was found that control was easy in one locality, where emergence occurred normally and quickly increased to a peak, but was more difficult in another district, where on account of late snow, two peaks occurred, the moths continuing to emerge for about a month between them.

County Agricultural Commissioners' Notes.—*Mon. Bull. Dept. Agric. California*, xix, no. 5, pp. 373–380. Sacramento, Cal., May 1930.

H. J. Ryan reports that an infestation by *Phylloxera* in a vineyard in Los Angeles County, the only one ever found in the county, is now well under control. All the vines have been pulled up, with as much of the root as possible. Over 3,500,000 individuals of *Cryptolaemus* [*montrouzieri*, Muls.] have been liberated in *Citrus* orchards in three weeks against the citrophilus mealybug [*Pseudococcus gahani*, Green], infestation by which appears to be less severe than in recent years.

D. P. Wheeler states that *Lepidosaphes ficus*, Sign., a pest of figs in Tulare county, is to be found all the year round on the leaves, fruits and limbs of the trees, the fruit and smaller limbs being preferred. Experiments showed that it can be completely controlled by a thorough application of a dormant oil spray just before the leaves come out.

T. D. Urbahns reports that *Malacosoma disstria*, Hb., has caused considerable injury during the last two seasons in Sutter county to the foliage of prune and peach trees. In many cases the moths flying from neighbouring uncultivated lands in the summer deposited their eggs on the trees. On peach, infestations are largely prevented by regular orchard pruning, many of the eggs which are laid on the twigs being thus destroyed. In prune orchards, however, the eggs remain on the trees, and the larvae finally appear in destructive numbers. Spraying with 3 lb. basic lead arsenate to 100 U.S. gals. water, as soon as injury becomes apparent and while the larvae are small, has proved very effective.

A. E. Bottel reports that, in general, injury to *Citrus* by the citrus thrips [*Scirtothrips citri*, Moult.] has slightly increased during the past few years in Riverside county. In areas where the damage is severe enough to necessitate it, one application of finely ground sulphur dust, between the blossoming period and the time the fruit is as large as a pea, gives sufficient control. The total cost of dusting an acre during the past season has been about £1. *Deilephilia* (*Celerio*) *lineata*, F., has caused serious injury to a large variety of plants. Vines were attacked in several localities and all the new season's growth destroyed. In some cases the migrating larvae were destroyed by digging trenches, 8–10 ins. deep, across their line of advance. Quicklime was placed in the trench to kill them, or holes were dug at intervals of 50–100 feet in which they were killed with oil. Infested plants should be sprayed with 4 lb. lead arsenate to 100 U.S. gals. water.

FAJARDO (T. G.). **Studies on the Mosaic Disease of the Bean** (*Phaseolus vulgaris* **L.**).—*Phytopathology*, xx, no. 6, pp. 469–494, 8 figs., 23 refs. Lancaster, Pa., June 1930.

Bean mosaic is one of the most serious diseases of beans (*Phaseolus vulgaris*) in the United States, where it is co-extensive with their cultivation. The general symptoms and effects of the disease are described, including symptoms of plants infected during the season and plants originating from infected seed. Although the virus, which appears to be present in all aerial vegetative parts of plants affected with mosaic, is normally transmitted through the seed, it has also been successfully transmitted by *Aphis rumicis*, L., *Myzus persicae*, Sulz., *Macrosiphum gei*, Koch (*solanifolii*, Ashm.), and one species of mealybug. A higher percentage of infection was produced by 15 or more infected Aphids on a plant than by smaller numbers, although a single infected individual of either *A. rumicis* or *M. persicae* was found to cause infection in some cases. Tests with other insects found feeding on bean plants in the field gave negative results, as did several trials with *Empoasca fabae*, Harr. (bean leafhopper), reared on infected bean plants. Great variations in the prevalence of the disease were observed in a given locality. These are chiefly determined by the number of diseased plants originating from infected seed, and secondarily by the relative prevalence of Aphids which may act as vectors. According to present knowledge, the virus is carried over from one season to

another only in infected seed. Early planting, which enables the plants to go through their period of vegetative activity before the Aphids become abundant, will secure a considerable reduction in the amount of field infection and the extent of injury. A wide difference has been observed in the amount of seed transmission between the early and late varieties. The percentage of seed infection is correlated with the stage of the plant when infection occurs, and decreases as the plant approaches the blossoming period. Plants infected after the blossoms are set show no seed infection.

Section of Plant Quarantine and Inspection.—*J. Econ. Ent.*, xxiii, no. 3, pp. 487–576, 2 pls. Geneva, N.Y., June 1930.

This series of papers includes: Some fundamental Qualifications for Regulatory Employees, by F. N. Wallace (pp. 487–494); The Japanese Beetle [*Popillia japonica*, Newm.] in 1929, by L. B. Smith (pp. 495–501); Treatment of Soil to destroy the Japanese Beetle, by W. E. Fleming and F. E. Baker (pp. 502–508); The Mediterranean Fruit Fly [*Ceratitis capitata*, Wied.] Eradication Campaign, by L. A. Strong (pp. 509–512); The Mediterranean Fruit Fly Situation, by W. Newell (pp. 512–535); Transportation Systems in their Relation to the Enforcement of domestic Plant Quarantines, by S. B. Fracker and R. A. Sheals (pp. 536–544); The present Status of the Plant Inspection Work in Missouri, by K. C. Sullivan (pp. 550–553); and How the Plant Division, Missouri State Board of Agriculture, serves the Grower, by G. D. Jones and B. F. Boillot (pp. 553–555).

In a paper entitled The Pine Tortoise Scale, *Lecanium numismaticum* Pettit and McD., in Nebraska (pp. 544–547), L. M. Gates discusses the history and distribution of *Toumeyella numismatica* in Nebraska, where serious injury was caused to plantings of Jack pine [*Pinus banksiana*] and Scots pine [*P. sylvestris*] in 1928. A commercial white oil emulsion used at 2 and 3 per cent. strength during the first two weeks of July gave excellent control of the scale without injuring the trees.

Other papers are: Hot Water Treatment of Narcissus Bulbs in Wisconsin (pp. 547–550), in which E. L. Chambers describes a device by which bulbs can be maintained for 2½ hours at a temperature ranging from 110° to 111·5° F., and which has proved completely effective in destroying *Merodon equestris*, F., *Eumerus*, *Rhizoglyphus hyacinthi*, Boisd., and Nematodes; and Practicability of the Hot Water Treatment for the Boxwood Leaf Miner, by E. N. Cory and C. Graham (pp. 563–565), in which an account is given of the successful treatment in spring against *Monarthropalpus buxi*, Lab., of 2,430 plants of the genus *Buxus*, ranging from 1 to 3 feet in height. The plants were inverted and immersed in water at 120° F. for 5 minutes. Only slight temporary injury was caused to the foliage, and the cost was approximately 4*d*. a plant.

Yothers (M. A.). **Summary of Results obtained with Trap Baits in capturing the Codling Moth in 1927.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 576–587, 3 graphs, 1 ref. Geneva, N.Y., June 1930.

The following is taken from the author's summary and conclusions: This paper is a progress report on the use of bait traps for *Cydia*

(*Carpocapsa*) *pomonella*, L., in Washington [*R.A.E.*, A, xvi, 80; xviii, 68, etc.]. The four seasons' experiments show that large numbers of moths can be captured. Tests in 1927 confirm those of 1926 that molasses ferment bait is rather more attractive than apple ferment. Certain cheaper grades of molasses are apparently as attractive as the higher-priced ones, and bait-pans capture more moths when at a level with the tops of the trees than when placed within the tree-tops. The addition of yeast to molasses gives better results than those that depend upon chance fermentation. The medium dark molasses seems to reach its maximum efficiency at a dilution between 1 : 10 and 1 : 20, but heavier grades may be diluted more, possibly as much as 1 : 20. Better results were obtained in replenishing pans of molasses bait with the regular formula than with water alone, although yeast need not be added each time. Data are presented that indicate a close relation between temperature fluctuations and flight activity of the moths.

The measure of supplementary control resulting from bait traps remains problematical, but the elimination of large numbers of female moths that have not oviposited must effect some reduction in the amount of infestation, and the traps have a definite value for fixing dates of spraying.

Taylor (R. L.). **A simple statistical Method for determining the approximate Duration of the Instars of leaf-mining Larvae and others.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 587–595, 1 fig., 6 refs. Geneva, N.Y., June 1930.

Comparative data on *Phyllotoma nemorata*, Fall., and *Coleophora salmani*, Hein., are given as examples of a statistical method here described for determining the duration of the instars of larvae that are case-bearers, moult in leaf-mines, or are otherwise not readily measured without removal from shelter.

Chandler (S. C.). **Supplementary Control Measures for the Oriental Fruit Moth.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 596–599. Geneva, N.Y., June 1930.

In experiments against *Cydia* (*Laspeyresia*) *molesta*, Busck, in southern Illinois in 1929, bands placed round peach trees in spring and examined twice a month caught an average of 2·2 larvae each up to the time of harvesting the early variety of peach, about mid-August. Those placed on later varieties after the earlier variety had been harvested caught from 6 to 151 larvae per band for the rest of the season. Banding of both trunks and main branches indicated that the larvae enter the bands from both directions, the numbers found on the upper and lower ones being about equal. In two orchards where the larvae were particularly numerous, 75 per cent. were situated just inside the band, forming a solid ring of cocoons along both the upper and lower edges.

Poor results were secured by growers in the autumn of 1928 from treatment with paradichlorobenzene, but in tests by the author in 1929, 90 per cent. of the larvae of *Aegeria exitiosa*, Say, and 70 per cent. of those of *C. molesta* were killed by the application on 28th September

of 1 oz. of paradichlorobenzene on 7-year-old peach trees, when the ground level was raised 3–4 ins., and 90 per cent. of the latter when it was not raised. The success of treatment is apparently dependent on soil temperatures and date of application. In studies during the winter of 1928–29, of 487 larvae of *C. molesta* found on the trees, 33 per cent. were between the ground line and a point 3 inches above it and might be reached by paradichlorobenzene.

FLANDERS (S. E.). **Mexican Sugar Cane-borers and the Parasite** *Trichogramma.*—*J. Econ. Ent.*, xxiii, no. 3, pp. 603–606. Geneva, N.Y., June 1930.

Very severe injury to sugar-cane in an extensive plantation on the west coast of Mexico was found in 1929 to be due to *Chilo loftini*, Dyar, and two species of *Diatraea*, 97 per cent. of the stalks and 25 per cent. of the joints showing signs of attack.

C. loftini, which is the most numerous and widely distributed, also causes the most serious damage, as it opens many points of entry for the sucrose-reducing fungus, *Colletotrichum falcatum*. About 75 per cent. of the infestation in the joints is attributable to it, its eggs being deposited in the crevices between the leaf-sheath and the stalk. The lack of moisture prevailing in the plantation concerned provides an optimum environment for this borer, which attacks the more fibrous lignified parts of the cane, making small characteristic transverse tunnels. Parasites obtained from *Chilo* were *Chelonus* sp., from two out of six cocoons of which the larva of a hyperparasite was obtained, and an Ichneumonid, which attacks the full-grown larvae and pupae. Although *Trichogramma minutum*, Riley, readily attacks the eggs of this moth in the laboratory, parasitism is unlikely to occur to any extent in the field owing to their protected position.

The species of *Diatraea* appear to be somewhat variable in distribution, but are probably responsible for 25 per cent. of the infestation of the joints. They chiefly attack the growing points of the plants and the internodes, and although they also prepare the way for *Colletotrichum falcatum*, their importance is mainly due to the destruction of the young cane. The females are attracted to dense stands, so that the more vigorous, succulent cane is more highly infested, and the attack occurs only during the warm, humid months when growth is rapid. In cases where a dead heart is formed, a single borer causes the death of the plant ; in old cane the tunnels extend lengthwise in the stalk. There are probably three generations a year, the adults first appearing about the middle of May. The eggs are deposited near the midrib of the leaf.

Both species are parasitised in the field by *T. minutum*, but the mortality of the parasite in the eggs of the larger and more injurious species is very high. The only other parasite observed was a Dexiid fly. In August 1929 T. Vogliotti observed the effect of liberating several millions of *Trichogramma*. Parasitism amounted to 24·2 and 63·2 per cent. in colonised fields and 7·1 and 30·3 per cent. in uncolonised fields in the case of the large and small borers respectively. In view of the large area of leaf-surface in a stand of sugar-cane, which *Trichogramma* must cover to find host eggs, it is considered useless to liberate it early in the season when eggs are scarce. When they are fairly abundant at the end of June and the natural parasitism is 1 per cent.

or more, the natural accretion over a large area is not likely to be affected by liberations. A possible means of initiating an early building up of the parasite population is colonisation at egg concentration points during May and the first part of June. A series of strong lights or baits placed at intervals throughout the planting should result in heavy egg deposition in the vicinity of each attractant.

Breeding of *T. minutum* was begun at the laboratory on 20th February 1929. *Sitotroga cerealella*, Ol., was collected by the burlap method [*R.A.E.*, A, xvii, 559] from stored maize, and the initial stock of *T. minutum* was obtained from the eggs of *Danaida plexippus*, L. (*Danais menippe*, Hb.). Although eggs of *Ephestia cautella*, Wlk., did not prove suitable for mass production of the parasite, it showed a marked preference for them in the presence of *S. cerealella*. Adult parasites developing on *Ephestia* lived for a shorter time than those bred on *Sitotroga*, and if any eggs of the former remained unparasitised, the resulting larvae fed on the surrounding eggs and spun a mass of webbing over the entire surface. The shortest period of development of the parasite from egg to adult was 6 days at temperatures ranging from 80 to 90° F., and at an average humidity of 75 per cent. The progeny of 3 females amounted at the end of 7 weeks to 300,000, which represented the sixth generation.

It does not appear probable that the cane-borers on the west coast of Mexico will be controlled by the use of the native strain of *Trichogramma*, as the two most destructive species are apparently not attacked to any extent, but the use of *T. minutum* for the control of the sugar-cane borer [*Diatraea saccharalis*, F.] in Louisiana has apparently a greater chance of success.

Miller (J. H.) & Crisfield (G. F.). **The Presence in Georgia of** *Bracon mellitor* **Say, a Parasite of the Cotton Boll-weevil.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 607–608, 1 ref. Geneva, N.Y., June 1930.

Microbracon (*Bracon*) *mellitor*, Say, which has been recorded as occurring extensively in Texas and Oklahoma, having the same distribution as the cotton boll-weevil [*Anthonomus grandis*, Boh.], appeared in 1929 in cotton fields in all parts of Georgia investigated. The Braconids were found continuously in one locality from June until 15th September, when observations were temporarily abandoned. Cotton bolls and squares containing the weevil larvae were picked from day to day, and the number of larvae parasitised was recorded. The habits of the parasites were studied in the laboratory. When placed in contact with bolls and squares, the female repeatedly attempted to penetrate them with its ovipositor, but was unsuccessful except where it encountered the weevil puncture. An egg is deposited in the cavity beside the weevil larva, and the Braconid larva feeds on the latter. The complete life-cycle occupies 10–18 days at midsummer, about 25 days in June, and much longer in autumn.

The rate of parasitism averaged 10 per cent. in June and rose to 18 per cent. in bolls and 35 per cent. in hanging squares in August in a field subjected to constant observation, and it is probable that the percentage could be materially increased by breeding and distribution of the parasites. Parasitism was always greater in bolls and squares on the plant than in fallen ones. The adult parasites were chiefly found around the tops of the cotton plants.

Hartzell (A.) & Wilcoxon (F.). **Naphthalene Fumigation at controlled Concentrations.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 608–618, 2 pls., 1 fig., 9 refs. Geneva, N.Y., June 1930.

A method of maintaining a constant concentration of naphthalene is described as an improvement on former methods of greenhouse fumigation with this substance, such as broadcasting or volatilisation with lamps or electric hot plates. An air-tight rectangular metal box, 47 ins. long, 25 wide and 35 high, was divided into four compartments by three vertical baffles, and each compartment contained eight horizontal shelves, on which was placed a single layer of naphthalene balls. Air was drawn in at one end of the box and travelled through each compartment in succession, being finally expelled through an opening in the top at the opposite end. This was done by means of a motor-driven blower, and the air in passing over the shelves became partly saturated with naphthalene vapour. The final concentration of naphthalene in the air at a given temperature could be controlled either by varying the number of shelves or by varying the speed of the blower.

A concentration of 0·008 lb. of naphthalene per 1,000 cu. ft. of air produced by this method and maintained for 8 hours was found to kill *Tetranychus telarius*, L., *Tarsonemus pallidus*, Banks, *Thrips tabaci*, Lind., and *Heliothrips femoralis*, Reut., without injury to a number of plants that have proved intolerant to methods used previously. The air near the plants was about 13 per cent. saturated with naphthalene vapour. The only plants showing signs of injury were buckwheat, soy beans and one variety of *Capsicum annuum*. Fumigation was carried out by this means in the daytime as well as at night. The method of analysing the air for naphthalene is described.

de Ong (E. R.). **The comparative insecticidal Value of different Species of Derris.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 619–624, 5 refs. Geneva, N.Y., June 1930.

The following is taken from the author's summary and conclusions: Identified specimens of *Derris elliptica*, *D. heptaphylla*, *D. polyantha* and *D. trifoliata* were tested comparatively to determine their insecticidal values. Experiments were made with ether extracts of the roots and trunks, dissolved in alcohol or pyridine and diluted with water, and with pure dusts made by grinding specimens of different parts of the plants.

All the species tested showed sufficient insecticidal value to warrant commercial experiments both with ether extracts and the ground powder. *Derris elliptica* showed a certain degree of superiority over the others, but not such as to warrant classifying the latter as inefficient. Valuable inherent properties were found in all species tested as toxic agents in immersion tests, as dusts on Aphids, and as repellents for a leaf-feeding caterpillar. These toxic values were found to be present in all parts of the plants tested, although in slightly varying amounts.

Fulton (B. B.). **The Relation of Evaporation to Killing Efficiency of Soap Solutions on the Harlequin Bug and other Insects.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 625–630, 1 ref. Geneva, N.Y., June 1930.

The following is taken mainly from the author's abstract and conclusions: Tests of various known contact insecticides against the

Pentatomid, *Murgantia histrionica*, Hahn, indicated that certain soap solutions are very effective, but only under conditions of low evaporation. A description is given of further experiments, carried out under known rates of evaporation, which show that the efficiency of soap solution is inversely proportional to the rate of evaporation. It was found that the addition of hygroscopic substances, such as glycerine, diethylene glycol and triethanolamine, did not materially increase the effectiveness. Tests with several kinds of soap and two other insects (the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] and an Aphid) show that this relationship is probably a general one.

Soap solutions kill the bugs by penetrating deeply into the tracheal system through the spiracles. A small amount of soap solution in one or two of the tracheal trunks probably does not cause death. On account of the spiracle-closing devices in the adult bugs, soap solutions must remain in the body several minutes before a quantity sufficient to cause death enters the tracheae. A much shorter time is required to kill the nymphs, on account of the rudimentary condition of the spiracle-closing devices, though many of them may escape under conditions of very rapid evaporation. Much better results can be obtained by spraying when the dew is on the plants or during a light rain than on a clear dry day, particularly if the wind is blowing. Under calm, cloudy, humid conditions soap is a very effective insecticide in solutions of $\frac{1}{2}$–2 per cent., depending on the insect to be treated.

DEARBORN (F. E.). **Physical and chemical Properties of commercial arsenical Insecticides. I. Manganese Arsenate.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 630–635, 7 refs. Geneva, N.Y., June 1930.

The following is the author's abstract: The patented methods of making manganese arsenates for insecticidal use consist in treating a manganese compound, such as pyrolusite, with white arsenic (As_2O_3) in the presence of nitric acid as a catalyst. The manganous arsenate formed is partly converted to the trimanganoarsenate by treatment with manganese carbonate to lower the water-soluble arsenic content. The brown colour of the insecticide is produced by treating the mixed arsenates with lime, which decomposes some of the arsenates, with the formation of calcium arsenate and hydrated oxides of manganese. Burnt umber is also generally added to cheapen the product.

The chemical analysis of the commercial insecticide shows that the total arsenic content runs close to 40 per cent., calculated as arsenic pentoxide, As_2O_5; that the water-soluble arsenic content ranges from 0·7 arsenic pentoxide, As_2O_5; and that the total manganese calculated as to 1·5 per cent. calculated as manganous oxide (MnO) ranges from 31·6 to 40·7 per cent. The lime content, present mostly as calcium arsenate, ranges from 15·5 to 16·4 per cent. calculated as calcium oxide (CaO).

The commercial manganese arsenate insecticide is a complex mixture of various arsenates of manganese, calcium arsenate, oxides of manganese, and smaller quantities of aluminium, iron, silica, etc. The composition of different samples is not the same.

Experiments with manganese arsenate against insect pests are briefly reviewed from the literature.

Snapp (O. I.) & Swingle (H. S.). **Preliminary Report on Paradichlorobenzene Solutions for the Control of the Lesser Peach Borer,** *Aegeria pictipes*, **G. & R.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 636–638, 5 refs. Geneva, N.Y., June 1930.

Aegeria pictipes, G. & R. (lesser peach borer), which has been a pest of considerable importance on peach since 1896, also attacks plum, cherry, June berry [*Amelanchier*], beach plum [*Prunus maritima*] and chestnut [*Castanea*]. Injury is due to the feeding of the larvae on the cambium and inner bark layers, which results always in the weakening of the tree and sometimes in the girdling and death of limbs. Severe injury is mainly confined to older trees, as the larvae apparently prefer to enter through wounds in the outer bark or at old crotches. Owing to the absence of satisfactory control measures, heavy infestations have hitherto been general in peach orchards in Georgia. An account is given of experiments in 1928 and 1929 with solutions of paradichlorobenzene applied to the infested parts of the trees with a brush [*cf. R.A.E.*, A, xvi, 637].

Spring applications gave uniformly better results than those made in November, owing to the more rapid volatilisation of the paradichlorobenzene caused by the higher temperature. The average temperature was 69·1° F. in the spring and 57·7° F. in the autumn tests. Apparently, autumn applications should be made earlier than November. Crude cottonseed oil (2 U.S. qts. to 1 lb. paradichlorobenzene) proved the best solvent, probably on account of its superior spreading and penetrating power. Soluble pine-tar creosote (1 U.S. qt. to 1 lb.) and melted paraffin wax (4 lb. to 1 lb.) both proved effective, but grafting wax, without being more effective than either of these materials, was much more disagreeable to use. Cottonseed oil and creosote solutions do not need to be kept warm during application, and both these solvents showed some insecticidal action when used alone, apparently acting by contact. No injury to trees could be detected.

Leonard (M. D.). **An unrecorded Food-habit of the Large Tobacco Suck-fly in Porto Rico.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 640–641. Geneva, N.Y., June 1930.

Dicyphus luridus, Gibson (large tobacco suck-fly), which has been for some time a minor pest attacking the leaves of tobacco in Porto Rico, is recorded for the first time as feeding on the flower-buds.

This Capsid was exceedingly numerous on 14th March 1930 on plants selected for breeding purposes, situated in the centre of a large field of tobacco. The extraction of the juices caused the flower-buds to fall, thus reducing the number of potential seed-capsules to not more than 10 per cent. in many cases. Paper bags fastened over each flower-head to prevent cross-pollination had failed to keep out sufficient of the insects to avoid considerable loss.

Haseman (L.). **Further Notes on the Hawthorn** *Carposina* **which attacks Apples in Missouri.**—*J. Econ. Ent.*, xxiii, no. 3, p. 641. Geneva, N.Y., June 1930.

The species of *Carposina* recently observed in Central Missouri causing injury to apple [*R.A.E.*, A, xviii, 389] has now been identified as *Carposina fernaldana*, Busck.

Campbell (F. L.). **Terpineol, a Solvent for removing a commercial Tree-banding Material.**—*J. Econ. Ent.*, xxiii, no. 3, p. 641. Geneva, N.Y., June 1930.

Of a number of solvents tested for dissolving a commercial tree-banding material from insects caught on screens smeared with this adhesive, only one, terpineol, proved entirely satisfactory. The insects are immersed in this solvent, which is then heated on a boiling water bath for 5 minutes or longer. When clean, they can be either transferred directly to alcohol or pinned. Specimens that have been preserved in alcohol can be treated equally well.

Johnson (H. G.). *Dicyphus minimus* **Uhler, a Pest on Tomatoes (Hemiptera, Miridae).**—*J. Econ. Ent.*, xxiii, no. 3, p. 642. Geneva, N.Y., June 1930.

The Capsid, *Dicyphus minimus*, Uhler, was found to be responsible for an unusual type of attack on tomatos occurring in Texas in 1929. It was first reported early in July and continued to be abundant throughout the summer and autumn. The nymphs were found principally on the lower surface of the leaves, but the adults occurred on any part of the plant. Leaves, stems, blossoms and small fruits were attacked, all showing lesions caused by feeding punctures. The young fruits dropped off, and a very considerable reduction in the crop was caused. *D. minimus* has been recorded as a serious pest of tobacco in Florida, where it has also been observed on tomato and egg-plant ; it has been found breeding on *Nicotiana trigonophylla* [in Arizona] and on *Solanum nigrum* in Mississippi.

Wolcott (G. N.). **Peruvian Potato Pests.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 643–644. Geneva, N.Y., June 1930.

Though potato tubers are sometimes infested by certain weevils in Peru [*R.A.E.*, A, ii, 241], they are more often attacked by the cutworm, *Lycophotia interrupta*, Mssn., which feeds on them in the ground, hollowing out large cavities that render them unfit for human consumption. The cutworms are, however, beneficial in consuming small or waste potatoes and preventing their giving rise to inferior plants in the following crop. *L. interrupta* was found near Lima ; the extent of its distribution is not known. With the exception of a few leafhoppers (*Cicadella* sp.), potato foliage in this neighbourhood appears to be free from insect attack, but in the mountains *Epicauta latitarsis*, Haag, and the Dasytid beetle, *Astylus sublunatus*, Pic., have been observed to cause very serious damage.

Stoner (D.) & Wisecup (C. B.). **Injury to Celery in the Sanford, Florida, District by the Larvae of the Noctuid Moth** *Perigea sutor* **Guen.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 644–645. Geneva, N.Y., June 1930.

Perigea sutor, Guen., which occurred on celery in a few localised areas in this district of Florida in 1928–29, was abundant and widely distributed there during the earlier part of the growing season of 1929–30 and caused a certain amount of damage to the crop. Field observations indicate that the larvae are most abundant in celery

of medium or large size in December and January, after which their numbers dwindle. They apparently feed at night, being often found during the day sheltering in the crown of the plant, where little injury occurs. Large irregular cavities are cut at the bases of the petioles, and the surrounding area frequently decays, rendering this part of the plant unfit for packing and necessitating increased stripping. Of 60 celery plants taken at random from a heavily infested field in December, 17 were badly and 31 slightly injured. As *P. sutor* was nearly twice as numerous as other larvae present in the field, it appears that the greater part of the injury was caused by it. The other Lepidopterous larvae observed on celery at this time included *Xylomyges* (*Prodenia*) *eridania*, Cram.

Douglass (J. R.). **Longevity of the Mexican Bean Beetle in the Southwest.**—*J. Econ. Ent.*, xxiii, no. 3, pp. 645–646. Geneva, N.Y., June 1930.

Studies of the longevity of the Mexican bean beetle [*Epilachna corrupta*, Muls.] carried out from 1924 to 1929 in New Mexico indicate that the average length of the life of these beetles is about a year. One female lived over 500 days, but no beetles survived the whole of a second winter.

Studies of Insect Pests.—*42nd Ann. Rep. S. Carolina Expt. Sta., 1928–29*, pp. 57–70, 3 figs. Clemson Coll., S.C., December 1929.

Crioceris asparagi, L. (asparagus beetle) was discovered in South Carolina for the first time and caused damage in several counties. The injury done to cotton seedlings by *Thrips tabaci*, Lind., is very difficult to compute, but undoubtedly stunting and malformation of the plants occur, and lateral growth frequently starts from the buds in the axils of the cotyledon leaves. *Frankliniella fusca*, Hinds, also attacks cotton seedlings, though it is usually a pest of tobacco ; both these thrips were controlled by sprays of nicotine and soap, nicotine and oil emulsions or pyrethrum and soap. Against *Epilachna corrupta*, Muls. (Mexican bean beetle), magnesium arsenate was the only satisfactory poison ; calcium arsenate, which had been fairly satisfactory during dry seasons, scorched the beans considerably, and pyrethrum-soap sprays are only effective against moderate infestations. *Cerotoma trifurcata*, Forst. (bean leaf beetle) was unusually destructive. The Cerambycid infesting apple (giant root borer) [*R.A.E.*, A, xviii, 215] has continued to cause trouble. In clearing land, larvae were found in the roots of oak trees ; it is therefore suggested that apple orchards should not be planted in newly cleared land, especially where oaks have been growing, and as the larval development probably requires several years, such land should be planted with other crops for at least three years. *Cydia molesta*, Busck [*loc. cit.*] has now become a serious pest, the loss caused by it being estimated at about 12 per cent. of the peach crop. *Trichogramma minutum*, Riley, was an active parasite of the eggs, and *Macrocentrus ancylivora*, Roh., which is an effective parasite of the larvae in other States, will be introduced into South Carolina. Observations on *D*[*iatraea*] *zeacolella*, Dyar, on maize showed the occurrence of a partial third generation, which has not previously been recorded. Considerable

damage to maize was also caused by *Laphygma frugiperda*, S. & A., *Elasmopalpus lignosellus*, Zell., and *Sphenophorus* (*Calendra*) *callosus*, Ol. Many of the eggs of the tomato fruit worm [*Heliothis obsoleta*, F.] were found to be parasitised by *Trichogramma*.

Hallock (H. C.). **The Asiatic Beetle, a serious Pest in Lawns.**—*Circ. U.S. Dept. Agric.*, no. 117, 7 pp., 3 figs., 9 refs. Washington, D.C., June 1930.

A brief account is given of the bionomics and distribution of *Anomala orientalis*, Waterh., in the United States and of methods for its control in lawns [*cf. R.A.E.*, A, xv, 442 ; xviii, 272, etc.].

Phillips (W. J.) & Barber (G. W.). **A Study of Hibernation of the Corn Earworm in Virginia.**—*Tech. Bull. Virginia Agric. Expt. Sta.*, no. 40, 24 pp., 2 figs., 8 charts. Blacksburg, Va., November 1929. [Recd. 1930.]

The following is taken from the authors' summary : This paper gives the results of experimental work and field observations on the hibernation of *Heliothis obsoleta*, F. (corn earworm) in central Virginia from 1921 to 1928, inclusive.

In summer the period from the time larvae entered the soil until moths emerged ranged from 14·6 to 19·9 days. The relative percentages of summer and autumn emergence from individuals that entered the soil during August and September varied with the food and the time when the larvae became full-grown. Larvae fed on dough-stage kernels seemed to have a tendency to hibernate even when they became full-grown in midsummer, whereas larvae fed on maize leaves showed a tendency to emerge during the autumn even when they became full-grown about the middle of September. Autumn emergence was greatest from those individuals that pupated at a depth of only 2–3 inches. Those individuals that entered the ground from the first to the third week in September usually hibernated most successfully, provided that they had had the proper food.

Larvae entering the soil construct a burrow for the escape of the adults. The pupae rest in a cell or enlarged space at the bottom of the burrow, at a depth of ½–9 inches, depending on the type of soil and the season. Larvae construct comparatively shallow burrows in the summer, but go much deeper in the autumn. About 43 per cent. of larvae that entered the soil failed to pupate, and mortality of the hibernating pupae was very high, averaging 95 per cent. Emergence may occur from the end of May until late in August ; the maximum emergence occurred during June and July. The minimum hibernation period was 248 days ; the maximum 367. Hibernating individuals may be present in the soil throughout the year. They hibernated more successfully in soils rich in clay than in lighter soils, except in soils very rich in humus. The kind and quantity of vegetation has a direct bearing on their survival. Roots often fill the emergence burrows or close their exits and prevent the escape of moths.

Moles are the most important predacious enemies of hibernating pupae in the area studied ; when they gained access to cages they destroyed as many as 92 per cent. Earth-worms frequently fill the emergence burrows with castings and thus may prevent the emergence of the moths.

Experiments have shown that *H. obsoleta* hibernates more successfully in a dry condition than under the normal precipitation of natural field conditions. A larger percentage of individuals hibernated successfully in the field cages during a season of very light precipitation. Field experiments indicated that excessive rains during the normal emergence period delayed emergence. Individuals emerged from dry hibernation considerably later than from hibernation under natural conditions. Shade was found to delay emergence and to limit the percentage that hibernates successfully.

Decker (G. C.). **The Biology of the Four-lined Borer,** *Luperina stipata* **(Morr.).**—*Res. Bull. Iowa Agric. Expt. Sta.*, no. 125, pp. 127–164, 22 figs., 17 refs. Ames, Iowa, May 1930.

Considerable local damage to maize has recently been caused in Iowa by *Luperina stipata*, Morr., the bionomics of which were studied from 1927 to 1929. Technical descriptions of all its stages are given. It is distributed over the north-eastern United States and part of Canada. Its natural food-plant is *Spartina michauxiana* (slough grass) and it has been found on other grasses, oats, etc., but maize, which is usually attacked by half-grown larvae migrating from other plants, is apparently the only plant of economic importance that it infests.

Only one generation occurs in a year. The eggs are deposited singly or in masses of up to 100 on the stems and leaves of grasses in late July or August, and hatch in late April or early May of the following year. The larval stage lasts 10–14 weeks, and pupation occurs just below the surface of the soil, the moths beginning to emerge in late July.

A detailed account is given of laboratory experiments on the effect of various factors, particularly temperature, on development. It was found that a diapause occurs in the egg stage, reactivation being the result of exposure to cold. The larvae develop most rapidly on succulent food, and a larger number of instars is required to complete development in woody stalks. The duration of the larval and the pupal stages varies according to temperature, but the larvae are not killed by any temperature normally occurring during their developmental period. After killing one plant, they enter a second. They may enter the plants at any point, but older larvae tend to work in the soil, and a whole hill of maize may be destroyed without their coming to the surface. It is probable that falling temperatures stimulate emergence, as the moths emerge during the late afternoon or night, the maximum occurring soon after the temperature drops below 75° F. The oviposition period varies from 3 to 17 days, the total number of eggs laid by one moth being probably about 500. During the day the moths hide under leaves and in the grasses ; they are not attracted by lights or sweetened substances. They tend to fly from high ground to low, moist situations where the food-plants of the larvae usually occur.

Very few parasites were reared from larvae taken from maize, but the percentage of parasitism of those in slough grass varied from 8 to 67. The species concerned were *Ceromasia senilis*, Mg., *Winthemia quadripustulata*, F., *Ectopimorpha* sp., *Amblyteles jucundus*, Brullé, *Meteorus vulgaris*, Cress., *Apanteles laeviceps*, Ashm., *A. militaris*,

Walsh, *Microplitis gortynae*, Riley, and *Lissonota brunnea*, Cress. Various Carabids, particularly *Calosoma calidum*, F., and occasionally Rhynchota, such as *Podisus maculiventris*, Say, and *Nabis ferus*, L., are predacious on the larvae, and moles and the short-tailed shrew (*Blarina brevicauda*) destroy the pupae. One bacterial and two fungous diseases were observed to attack the larvae, but did not seem to be an important factor in control. It is suggested that outbreaks of this moth might be prevented by burning large-stemmed grasses in fence rows and poorly drained fields between 1st November and 1st April. As most of the parasites hibernate in the soil, they would not be affected by such measures.

PETERSON (A.) & HAEUSSLER (G. J.). **Life History of the Oriental Peach Moth at Riverton, N.J., in Relation to Temperature.**—*Tech. Bull. U.S. Dept. Agric.*, no. 183, 37 pp., 22 figs., 16 refs. Washington, D.C., June 1930.

An account is given of the results of a detailed study of the life-history of the oriental peach moth, *Cydia* (*Laspeyresia*) *molesta*, Busck, in New Jersey, with particular relation to the effects of temperature.

The following is taken from the authors' summary: In 1925, five complete or partial generations were observed and in 1926 four complete or partial ones, the difference being largely due to decided differences in temperature between the two seasons. Observations on the lines of Glenn's investigations with regard to the codling moth [*C. pomonella*, L.] [*R.A.E.*, A, x, 479; xi, 22] indicate that although the two seasons were so different in temperature, the effective temperatures for development of both insects are from 50 to 86° F. The variation in the number of effective day-degrees required to complete the development of each stage in the life-cycle of *C. molesta* did not exceed 1 per cent. for the two seasons. It was shown that in the case of wintering larvae, the effective day-degrees in the autumn as well as in the spring must be considered in determining the time of emergence of the moths. A temperature of 52° F. is probably the zero of development for the stages in the overwintering cocoon. Although the 50 to 86° range of effective day-degrees is approximately correct if all the individuals of a given stage for an entire growing season are taken into consideration, there is a slight difference in the generations when the effective day-degrees are ascertained for a given stage in the several generations. It is possible that the zero of development for *C. molesta* may be somewhat below 50° for some stages, particularly the feeding period and possibly the cocoon period of the larvae that do not overwinter.

BROWNE (A. C.). **The Oil Emulsions, a brief Survey.**—*Mon. Bull. Dept. Agric. California*, xix, no. 6, pp. 389–408, 11 figs. Sacramento, Cal., June 1930.

The history of the use of oils against insect pests is briefly reviewed, and the qualities required in an oil spray are outlined. The derivation of oils and their properties are discussed, together with the process of sulphonation, the blending of oils, the types of emulsions, their preparation and their use in the field. A comparative study of non-soap emulsions shows that there is no true correlation between the distillation

rates of oil samples and their viscosity or their unsulphonated residue, nor between these properties and their rates of evaporation, except that as a general rule the higher the viscosity, the slower the evaporation.

From the limited observations made on the oil emulsions at present employed in California, it is concluded that the data are so widely at variance and there is so little opportunity of correlating one phenomenon with another, that it is not possible to devise a formula by which an entirely satisfactory insecticidal oil can invariably be selected.

FLANDERS (S. E.). **The Lima Bean Pod-borer in California.**—*Mon. Bull. Dept. Agric. California*, xix, no. 6, pp. 409–421, 4 figs., 6 refs. Sacramento, Cal., June 1930.

The Pyralid, *Etiella schisticolor*, Zell., is one of the most serious pests of lima beans (*Phaseolus lunatus*) in California, attacking the seed in the green pods. It is doubtfully distinct from *E. zinckenella*, Treit., under which name a brief account of its habits and the damage it causes has already been noticed [*R.A.E.*, A, xiv, 647].

A spring generation occurs on wild food-plants (*Lupinus*, *Lathyrus* and *Astragalus*), and a summer and a partial autumn one on lima beans. A small percentage of the spring generation may not reach the adult stage until the following year. The eggs hatch in 9–14 days, and the larvae are full-fed 2–4 weeks later. Those that mature in September may remain as larvae in their cocoons for 3–7 months, those maturing in April for 2–17 weeks, those maturing in May for 1–2 weeks, and those maturing in August for 1–5 weeks. Pupation of the overwintering brood may occur in winter but usually takes place in March or April. The pupal period lasts 38–88 days. In 1926 the pupation of the spring brood occurred from April to September, the average pupal period being 34 days. The pupation of the summer brood takes place in August and September, the pupal period averaging 32·5 days, although many of this brood may overwinter. The moths probably fly for miles to reach food-plants. In a cage experiment the average length of life for those emerging in September was 24 days. Two females captured in the field laid 250 eggs each.

A few of the larvae in lima beans were parasitised by *Microbracon* sp. and a Chalcid, *Zatropis tortricidis*, Crwf., but the percentage of parasitism was higher in the wild food-plants, the species concerned being *Microbracon gelechiae*, Ashm., *Microbracon tychii*, Mues., and another species closely resembling it, *Eurytoma* sp. and the Ichneumonids, *Pimpla* (*Epiurus*) *aplopappi*, Ashm., and *Trichomma maceratum*, Cress.

Cultural practices appear to offer the best prospect of control. Severe infestations in late beans are probably due to moths migrating from fields already harvested, but this is offset to some extent by the higher yield of these beans. Irrigation, which delays ripening and increases the crop, probably also decreases the resistance of the larvae to parasitic fungi and bacteria. Plantings that are irrigated 2 or 3 times during a season and kept under water for 72 hours at a time are free from injury. The hypertrophy of the pod tissues in lima beans, which in irrigated plants may kill the entering larvae, is not observed on native food-plants. Plants in an irrigated field tend to become biennial, and the late immature pods function as a trap crop and so prevent the injury caused by the newly hatched larvae of the third generation to the more

mature pods just before harvest. In the laboratory it was found that adults could not emerge from pupae at a depth of $\frac{3}{16}$ inch in compact soil, but could emerge easily from those at a depth of 2 inches in loose soil.

TUCKER (R. P.). **Some Notes on the Soluble Sulphurs.**—*Mon. Bull. Dept. Agric. California,* xix, no. 6, pp. 422–429. Sacramento, Cal., June 1930.

The alkali polysulphides or soluble sulphurs form an important group of insecticides, of which only the sodium and calcium polysulphides are used to any great extent at the present time. It is generally recognised that their value is due to the so-called polysulphides that they contain. The constituents of dry lime-sulphur, the formation and constitution of the so-called polysulphide molecule, and the decomposition of the soluble sulphurs are discussed. It is concluded that the polysulphides are made up of molecular sulphur (S_8) held in solution by an alkaline sulphide base of the general formula $CaOSH_2$.

The author considers that the toxicity of the soluble sulphurs is caused by a combination of two properties common to these compounds. In the first place, owing to their soap-like character they rapidly cover and penetrate greasy insects and fungi, and secondly, immediately on penetration, a large percentage of the soluble molecular sulphur is changed to the solid state. Such a transformation in the physical state of the sulphur should exert a very destructive action upon living tissue. Laboratory experiments indicate that decomposition of the soluble sulphurs in field practice must come largely from oxidation. Soon after application, the initial toxicity is spent owing to the change of the molecular sulphur from the liquid to the solid state, and any further toxicity exhibited will arise from the sublimation or oxidation of the elemental sulphur precipitated out of the original soluble sulphur spray. Owing to the tenacious and continuous film of deposited sulphur, the toxicity should be somewhat greater than could be expected from dusted sulphurs.

MAHONEY (A. E.). **Red Spider or Pacific Mite in San Joaquin County.** —*Mon. Bull. Dept. Agric. California,* xix, no. 6, pp. 452–453. Sacramento, Cal., June 1930.

Tetranychus pacificus, McGregor, has recently become of increasing importance as a pest of vines in San Joaquin County, California, sometimes causing complete defoliation. The weaker plants are first attacked, particularly those in low situations where there is a high or rapidly fluctuating water table, or on high sandy knolls where they do not receive sufficient moisture, but the infestation, once established, spreads to healthy plants, especially in the direction of prevailing winds.

Hibernation takes place in the adult stage, probably in cracks in the soil, under bark, or among rubbish and weeds. The life-cycle is shortened to 14 days in the hot weather in May and June, when the mite becomes numerous. In 1929, infestation reached its peak in August, after which it diminished rapidly owing to the activity of a predacious thrips, *Scolothrips sexmaculatus,* Perg. It might be possible to breed this thrips in the laboratory during the winter in sufficient numbers to give effective control in early spring. Vineyards

should be kept well drained and irrigated, and clean cultivation should be practised. Fair control was obtained with 6 per cent. lime-sulphur, but a marked odour of hydrogen sulphide was apparent on the grapes. In experiments sprays of light summer oils or fish-oil soap were effective at a concentration of 1–3 per cent., the strength being increased as the season advanced. The cost was, however, considerable, and the sprays, particularly those of mineral oil, removed the bloom from the grapes. Ground sulphur dust applied as soon as the mites become active appears promising, but with all materials a thorough coverage, including the lower surface of the leaves, is essential.

MORRISON (A. E.). **Lesser Bulb Fly Found.**—*Mon. Bull. Dept. Agric. California*, xix, no. 6, p. 467. Sacramento, Cal., June 1930.

Eumerus sp. is recorded as infesting carrots over an area of 3 acres in California.

SWEZEY (O. H.). **Entomology.**—*Rep. Comm. Expt. Sta. Hawaiian Sugar Pl. Ass.*, 1927–28, pp. 15–25 ; 1928–29, pp. 16–25. Honolulu, 1929–30.

Some of the information in these reports has already been noticed [*R.A.E.*, A, xvii, 194]. Against the sugar-cane borer, *Rhabdocnemis obscura*, Boisd., an egg-parasite, *Anaphoidea calendrae*, Gahan, has been introduced from Missouri, where it parasitises billbugs [*Sphenophorus* spp.], but it has not apparently had much effect, and the chief control of the borer is still effected by the New Guinea Tachinid [*Ceromasia sphenophori*, Villen.]. Further search in New Guinea has not resulted in the discovery of any new parasite. Against armyworms, 11,350 individuals of the Chalcid, *Euplectrus platyhypenae*, How., and 34,700 of the Scelionid, *Telenomus nawai*, Ashm., were reared and distributed, the latter being now established on Kauai. Other parasites present in the field were the Tachinids, *Chaetogaedia monticola*, Big., and *Achaetoneura* (*Frontina*) *archippivora*, Will., and the Ichneumonid, *Hyposoter exiguae*, Vier., the total parasitism by the two latter amounting to 24 per cent. in the case of *Spodoptera mauritia*, Boisd. Several introductions of the Tortricid, *Bactra truculenta*, Meyr. (nutgrass borer) have been made from neighbouring islands to Hawaii and it should now be established. It has not proved of much value in destroying nut grass [*Cyperus rotundus*], however, except in a few areas. In three localities on Maui, 68–78 per cent. of the eggs of this moth were parasitised by *Trichogramma* sp. and *T. minutum*, Riley, and one caterpillar by the Braconid, *Chelonus blackburni*, Cam.

NICHOLLS (H. M.). **The Lucerne Flea** (*Sminthurus viridis*).—*Tasmanian J. Agric.*, i, no. 3, pp. 115–119, 2 figs. Tasmania, May 1930.

The presence of *Smynthurus viridis*, L. (lucerne flea) in Tasmania was not discovered until May 1929, although it was probably introduced in the egg stage in the earth of improperly-cleaned clover seed imported from South Australia about 1923. It has become rather numerous in two or three localities on the north-western coast. Very little lucerne is grown in the State, and it is mainly found on subterranean clover [*Trifolium subterraneum*] and other clovers. The

life-history is very similar to that in South Australia [*R.A.E.*, A, xvi, 381]. In ordinary seasons the springtails disappear about the beginning of December. The summer is passed in the egg stage, and hatching occurs about the end of March. The climate of Tasmania is moister than that of South Australia, and the period of aestivation is consequently shorter.

In experiments, spraying with lime-sulphur, 1 : 60, proved to be an effective method of control. The insects were killed by contact and by eating the sprayed leaves. Some of them after jumping on to the treated foliage were poisoned by cleaning their feet with their mouthparts. On several occasions dead females were observed on the ground by patches of uncovered eggs, which indicated that in attempting to cover their eggs [*loc. cit.*] they had been poisoned by ingesting the sprayed earth. On experimental plots cattle ate infested clover that had been sprayed, but would not feed on the heavily infested unsprayed areas.

Regulations have been promulgated prohibiting the importation of clover seed that has not been machine-dressed. *S. viridis* spreads very slowly, and there is little doubt that proper treatment of pastures will prevent any appreciable damage.

ANGELL (H. R.), HILL (A. V.) & CURRIE (G. A.). **Blue Mould of Tobacco : Progress Report of Studies on an Insect Vector.**—*J. Council Sci. Ind. Res.*, iii, no. 2, pp. 83–86, 2 refs. Melbourne, May 1930.

In 1929, tobacco seedlings in New South Wales became infected with blue mould fungus at the time that adults of *Phthorimaea operculella*, Zell., were first observed in the seed-beds. As the beds were situated more than two miles from the nearest diseased plants, these moths were suspected of carrying the conidia, although there was also the possibility that they were carried by wind or other agencies. Experiments described showed that moths collected from diseased seed-beds carry the conidia mechanically, and that if they alight on healthy seedlings, infection results when conditions are favourable. The detached conidia sometimes remain viable for 54 hours or more. It follows that other insects attacking or even visiting seedlings may also be possible carriers of the conidia.

EVANS (J. W.). **The Control of the Codlin Moth in Australia. Notes on the possible Utilization of *Trichogramma* (Hym., Chalcidoidea).** —*J. Council Sci. Ind. Res.*, iii, no. 2, pp. 106–116, 18 refs. Melbourne, May 1930.

On account of the possibility of economically controlling the codling moth [*Cydia pomonella*, L.] and other insect pests in Australia by means of egg parasites of the genus *Trichogramma*, an investigation of the problem was recently undertaken. A brief history of work already done with these parasites is given. All the records of a pest having been controlled or partly checked by *Trichogramma* refer to infestations in the late summer or autumn, and it has been suggested that the scarcity of the parasite in spring is due to the shortage of host eggs in the previous autumn. Although this is no doubt partly correct, it is also probable that few of the parasites in the hibernating

eggs survive, and of those that do so the majority are too weak to oviposit. This supposition was borne out by laboratory experiments in which parasitised eggs were subjected to temperatures fluctuating between 1 and 10° C. [33·8 and 50° F.], although eggs kept at a constant temperature of 2° C. [35·6° F.] gave rise to healthy parasites.

In August 1928 investigations were begun at the Parasite Laboratory of the Imperial Institute of Entomology in England. As entomologists in America had experienced considerable difficulty in maintaining a constant stock of *Sitotroga* [*cerealella*, Ol.] owing to the activities of the predacious mite, *Pediculoides ventricosus*, Newp., attempts were made to use the eggs of various other insects as hosts, including those of *Tribolium castaneum*, Hbst., *Rhizopertha dominica*, F. (*pusilla*, F.), *Ephestia elutella*, Hb., *E. kühniella*, Zell., and *Endrosis lacteella*, Schiff. Only *E. lacteella* and *Ephestia kühniella* gave promising results. The former will be further investigated, but it was found that if any eggs of the latter were left unparasitised (and this was the usual occurrence), the larvae on hatching devoured the surrounding eggs or webbed them together [*cf.* *R.A.E.*, A, xviii, 577]. Eventually a stock of *S. cerealella* was obtained from Canada, and although no trouble was experienced with *Pediculoides*, considerable annoyance was caused by the presence of a mite of the genus *Tyroglyphus*. The mites and their highly resistant eggs were eliminated by exposing the wheat used for feeding *Sitotroga* to a dry heat of 52° C. [125·6° F.] for a period of 8 hours. The moths were reared at a temperature between 24 and 27° C. [75·2 and 80·6° F.] and a relative humidity of 80 per cent.

In the laboratory the author studied two races of the European species, *Trichogramma evanescens*, Westw. One consisted entirely of parthenogenetic females and was discovered in the eggs of *Rhyacionia buoliana*, Schiff., in England and the other was obtained from Germany. The latter strain was bisexual, unfertilised females giving rise to males only, and was originally found in the eggs of *Pieris* spp. Parallel tests were carried out with both races under identical conditions at a temperature of 25° C. [77° F.] in a dim artificial light. It was found that one adult of the parthenogenetic strain can parasitise 73 eggs of *Ephestia kühniella*, but on an average only parasitises 41. This parasite is most efficient during the first 5 days of its life. At 25° C. it will live as long as 13 days, ovipositing even on the 12th day. Twenty eggs were parasitised by one female within 36 hours whether they were laid in a mass or scattered over an area of 11 sq. ins. One female of the second strain can parasitise 99 eggs, but on an average only parasitises 62. Six days is the average duration of its life, and it is most effective during the first few days although 19 out of 20 eggs were parasitised on the sixth day. Fertilised females lay batches of eggs giving rise to more females than males, but if not re-fertilised may lay eggs that produce only males towards the end of their lives. The life-cycle of the obligatorily parthenogenetic race lasted ten days at 27° C., whereas that of the bisexual race and of the American *T. minutum*, Riley, lasted nine days at the same temperature.

The technique of rearing both *Sitrotroga cerealella* and *Trichogramma* is described in detail, the method being based on that used by S. E. Flanders [*cf.* *R.A.E.*, A, xvii, 455, 456, etc.], with certain modifications. The apparatus discussed is only intended for the production of sufficient eggs for field experiments, as it is not planned to establish a large laboratory at Canberra for purposes of distribution. In addition to the

species of *Trichogramma* already mentioned, it is proposed to undertake experiments with the indigenous *T. australicum*, Gir. [xvi, 102].

It has frequently been observed that females of *Trichogramma* that have fed on honey or other sugary substance, live longer and lay more eggs than those unfed, and it is therefore suggested that a small piece of raisin should be stuck on each card of eggs exposed in the field, in the hope that the parasites will feed before ovipositing.

Other pests in Australia that might be controlled by this parasite are *Caliroa* (*Eriocampoides*) *limacina*, Retz. (pear slug), *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental peach moth) and *Heliothis obsoleta*, F. (tomato worm).

[Reports of the] **Bureau of Sugar Experiment Stations.**—*Queensland Agric. J.*, xxxiii, pt. 6, pp. 372–380. Brisbane, 1st June 1930.

E. Jarvis advocates the protection of insectivorous birds, which are important natural enemies of many sugar-cane pests, and gives a list of 15 species frequently found in cane-fields. As a result of field trials of machines for applying dry or liquid soil fumigants to rows of sugar-cane, various recommendations are made regarding their construction.

In view of the varied opinions regarding the effect of heavy rains and floods on cane-grubs [*Lepidoderma albohirtum*, Waterh.], R. W. Mungomery discusses experiments in which third-stage larvae were submerged for periods of 1–5 days. After 1–2 days they quickly recovered, and though after 3–4 days recovery was much slower, a fairly high percentage survived. Only a small percentage remained alive after 5 days immersion. Infested cane-fields seldom remain under water for long periods, however, and during three weeks continuously rainy weather in January and February, no dead grubs were found in water-logged soil that was not actually flooded. Wet weather may, however, render the larvae more susceptible to fungous diseases, and in occasional cases torrential rains may wash them out of the soil to be eaten by birds.

Tanabe (C.) & Mishima (R.). **On the Life-history and Methods of Control of** *Rhaphidopalpa femoralis* **Motsch.** [*In Japanese.*]—*J. Plant Prot.*, xvii, pp. 291–293 & 378–383. Tokyo, 1930.

The Galerucid, *Rhaphidopalpa femoralis*, Motsch., is very injurious to water-melon in the Nara Prefecture. There is one generation a year, the beetles usually emerging in August and hibernating in sheltered places from the end of October. They are, however, occasionally observed on warm days during the winter. They become active about the middle of March, when the temperature of the soil is above 10° C. [50° F.], and are seen flying from the end of April. They feed on the leaves of cucurbits. Oviposition occurs from the end of May until the end of June or sometimes later. The beetles, which live about a year, are active on fine days and feign death when disturbed. The female oviposits about 12 times, laying a total of about 550 eggs in cracks in the ground or under the soil. The larvae hatch in about 2 weeks, being most numerous from June until the middle of July, and feed on the roots of cucurbits. The larval and pupal stages last about 33 and 14 days respectively.

HARUKAWA (C.). **Studies on** *Eriocampoides matsumotonis*, **Haruk.** [*In Japanese.*]—*Mat. Improvement Agric., Dept. Agric. For.*, no. 14, pp. 1–37, 2 pls. Tokyo, March 1930.

Injury by the larvae of the sawfly, *Caliroa* (*Eriocampoides*) *matsumotonis*, Haruk., which feed on the upper surface of the leaves of pear and to a less extent of peach and other species of *Prunus*, was first observed more than 20 years ago in the Okayama Prefecture. There are three generations a year, the adults appearing from June to September and hibernation taking place as mature larvae in cocoons in the soil. The females insert their eggs into the leaves from the lower surface. Unfertilised eggs apparently yield only males. One female lays about 20 eggs during its life, which lasts 2–5 days. The larvae hatch in 7–11 days and mature in 14–23. The prepupal stage lasts 10–15 days in summer, and the pupal stage 4 or 5. Descriptions are given of three species of Ichneumonids that are parasitic on the larvae. Spraying with lead arsenate is recommended for control.

KATSUMATA (K.). **Results of the Studies on** *Scotinophara* (*Podops*) *lurida*, **Burm.** [*In Japanese.*]—240 pp., 5 pls., 1 chart. Ishikawa, Ishikawa-Ken Agric. Expt. Sta., March 1930.

The Pentatomid, *Scotinophara lurida*, Burm., is widely distributed throughout Japan, where it is one of the most important pests of rice. It also attacks wheat, *Panicum crusgalli* and *Zizania latifolia*, and in cages has been found to feed on maize, Italian millet [*Setaria italica*] and *P. miliaceum*. One of each sex to each rice plant in spring may be responsible for the total loss of the crop. There is one generation a year, hibernation taking place in the adult stage under fallen leaves and among grasses near the rice-field. Oviposition begins 2–3 weeks after migration from the hibernating places in June and July. The adults, which are strongly attracted to light at night, usually live about 10 months. They generally fly in the evening and can cover fairly long distances. They shelter on the lower parts of the food-plants on fine days and feign death when disturbed. The eggs are laid on the leaves and leaf sheaths between 6 and 8 p.m., from late June to mid-August, but mostly about the end of July. One female lays up to 611 eggs, with an average of 190. They usually occur in two or sometimes three compact rows, 14 in each row, and hatch after 4 days in the early morning. In the laboratory, 94·4 per cent. of the eggs hatched. The adult stage is reached in 27–46 days, and the bugs leave the rice-fields for hibernation in September and the first half of October. Early-planted varieties of rice are most heavily infested, and densely planted fields seem to be preferred.

Telenomus sp. is parasitic in the eggs, killing about 95 per cent. in August. It has 8–10 generations a year, each female laying about 50 eggs. The Carabids, *Pterostichus microcephalus*, Motsch., *Anchomenus* (*Agonum*) *daimio*, Bates, and *Chlaenius pallipes*, Gebl., feed on the eggs and nymphs; and *Anisolabis maritima*, Géné, has been observed to attack the bugs in captivity. They are also destroyed by frogs and ducks. The fungus, *Metarrhizium anisopliae* (*Oospora destructor*) causes considerable mortality among the adults and nymphs. Control measures recommended are sparse planting, submerging the plants to kill the eggs, and dusting with nicotine.

Saito (K.). **The Effect of Insects upon the Appearance of Trees in Korea.** [*In Japanese.*]—*Sci. Bull. Alumni Soc. Morioka Coll. Agric. For.*, v, pp. 139–146. Morioka, March 1930.

Brief notes are given on some forest insects that produce galls on or deform trees in Korea. *Phassus signifer*, Wlk., takes two years to complete its life-cycle, the adults appearing in September. The larvae bore in ash (*Fraxinus*), *Paulownia tomentosa*, etc. *Omphisa plagialis*, Wilem., the larvae of which bore in *Catalpa speciosa*, has two generations a year, the adults emerging at the end of May and again at the end of September. *Dioryctria splendidella*, H.S., which feeds on *Pinus densiflora* and *P. rigida*, also has two generations a year. The moths appear in June and again in August, and they oviposit on the young shoots and fruits, in which the larvae mine. *D. abietella*, Schiff., has probably two generations a year, the larvae boring into full-grown spruce (*Picea*). They were also found in galls made by *Chermes* sp. on these trees. *Rhyacionia* (*Grapholitha*) *turionana*, Hb., and *Myelophilus piniperda*, L., attack pines, the adults of the latter emerging at the end of June and in July.

Tempany (H. A.). **Entomological Division.**—*Ann. Rep. Dept. Agric. S.S. & F.M.S. 1929*, p. 14. Kuala Lumpur, 1930.

Setora nitens, Wlk. (nettle caterpillar) caused considerable local damage to coconuts in Malaya in the first half of 1929. Coffee was attacked by the larvae of the Sphingid, *Cephonodes hylas*, L., and by *Stephanoderes* (*Cryphalus*) *hampei*, Ferr., the distribution of which is apparently confined to Selangor, Negri Sembilan and Malacca. Insects injuring rubber were the Arctiid, *Cyana ridleyi*, Hmps., and the locust, *Valanga nigricornis*, Burm., which caused some damage to young bud-grafts.

Miller (N. C. E.) & Pagden (H. T.). **Insect Pests of Padi in Malaya.** —*Malayan Agric. J.*, xviii, no. 6, pp. 289–292, 3 refs. Kuala Lumpur, June 1930.

Rhynchota attacking rice in Malaya include *Tetroda histeroides*, F., which has been found to be injurious in Madras [*R.A.E.*, A, xvii, 654]; *Scotinophara coarctata*, F. [*cf.* xii, 362]; *Leptocorisa acuta*, Thnb., which feeds on the ripening grains and causes them to turn blackish and then white when entirely empty; and *Sogata furcifera*, Horv. (*pallescens*, Dist.), which causes the plant to turn yellow. The eggs of *Sogata* are laid at the mid-rib of the leaves under the cuticle, and the nymphs appear to feed mainly on the leaf blades, but the adults are usually found just above the water level. If the water is drained off for about two days, the insect disappears. There are six Lepidopterous pests, three feeding on the leaves and three boring in the stems. Of the latter, *Diatraea auricilia*, Dudg., deposits eggs in masses of 30–200 on the leaf blades, and the larva pupates without making a cocoon. *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) also deposits eggs in masses on the leaf blades, the egg-mass being covered with brownish scales. *Sesamia inferens*, Wlk., oviposits beneath the leaf sheath, the eggs being laid in several rows, and the larva spins a loose web of silk, generally outside the stem. All these

borers can live in the submerged stems, apparently unaffected by the water in which they are immersed. They frequently cause the early death of the plant by completely ringing the node at the point of entry, after which they either enter the stem or leave it for another. The leaf-feeders are *Nymphula depunctalis*, Gn., the larvae of which bite off a portion of the leaf and fold it into a shelter in which they move about the plant and on the water, and two army worms, *Spodoptera mauritia*, Boisd., and *S. pecten*, Gn., the eggs of which are deposited on the leaves and covered with scales. The larvae are very conspicuous and may be readily dealt with before they do much damage.

Cotton Crop in Tanganyika.—*Tanganyika Standard*, 9th Aug. 1930. Typescript extract, 2 pp.

Owing to the recent damage by insects, which was favoured by abnormal seasonal conditions, the estimate of the cotton crop announced in May as 34,770 bales of 400 lb. each has had to be reduced to 22,000 bales, though if more favourable conditions prevail, the estimate may again have to be revised.

Frappa (C.). **Le charançon de la patate douce à Madagascar** (*Alcides convexus* **Ol.**).—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 5–6, pp. 215–217, 1 pl. Paris, May–June 1930.

Alcides convexus, Ol., the adult of which is described, caused considerable local injury to sweet potato in Madagascar in 1928 and 1929. The weevils appear in April or May when the plants begin to show some foliage, and feed on the leaves, so that the yield is reduced. Oviposition begins in May or June, the eggs being laid in the soil on the tubers, in which the larvae feed. Pupation takes place in the soil. The weevils disappear in August, when the foliage begins to wither.

Balachowsky (A.). **Contribution à l'étude des Coccides de France (4e note). Quelques Hyménoptères Chalcidiens parasites de Coccides recueillis dans les Alpes-Maritimes et le Var durant l'année 1929.**—*Rev. Path. vég. Ent. agric.*, xvii, fasc. 5–6, pp. 218–221, 6 refs. Paris, May–June 1930.

Brief notes are given on the following Chalcidoid parasites obtained from Coccids in the Departments of Alpes-Maritimes and Var during the summer of 1929: the Aphelinids, *Aphelinus* (*Aphytis*) *mytilaspidis*, LeB., from *Chionaspis berlesei*, Leon.; *A.* (*A.*) *diaspidis*, How., from *Diaspis echinocacti*, Bch. (*calyptroides*, Costa); *Azotus matritensis*, Mercet, from *Targionia vitis*, Sign.; *Aspidiotiphagus citrinus*, Craw, from *D. echinocacti* and *Aulacaspis rosae*, Bch.; *Prospaltella berlesei*, How., from *Aulacaspis* (*Diaspis*) *pentagona*, Targ.; *P. leucaspidis*, Mercet, from *Leucaspis pusilla*, Lw.; *Coccophagus insidiator*, Dalm., from *Eriococcus henryi*, Balachowsky; *C. scutellaris*, Dalm., from *Pulvinaria mesembryanthemi*, Vall.; *Coccophagoides similis*, Masi (*ilicis*, Mercet), found in association with *Azotus matritensis*, in the course of breeding *Targionia vitis*; and *Casca occidentalis*, Silv. & Mercet, from *T. vitis*; the Encyrtids, *Arrenophagus chionaspidis*, Auriv., from *Aulacaspis rosae*; *Anagyrus bohemani*, Westw., from *Ripersia*

delassusi, Balachowsky ; *Aenasioidea hispanica*, Mercet, from *Kermes* (*Kermococcus*) *bacciformis*, Leon., and *Chionaspis euonymi*, Comst. ; *Blastothrix erythrostethus*, Wlk., from *Kermes* (*Kermococcus*) *ilicis*, L. ; *Adelencyrtus aulacaspidis*, Brèthes, from *Aulacaspis rosae* ; *Encyrtus masii*, Silv., from *Filippia oleae*, Costa ; *E. frontalis*, Mercet [*sic* ? *frontatus*, Mercet] from *Pulvinaria mesembryanthemi* ; *Phaenodiscus aeneus*, Dalm., from *Lecanium* (*Sphaerolecanium*) *prunastri*, Boy. ; *P. coccidiphagus*, Mercet, from *Ripersia echinata*, Balachowsky ; *Protyndarichus coccidiphagus*, Mercet, from *Lecaniodiaspis sardoa*, Targ. ; and *Habrolepis dalmani*, Westw., from *Targionia vitis* ; and the Pteromalid, *Scutellista cyanea*, Motsch., from *Ceroplastes rusci*, L., and *Saissetia oleae*, Bern.

FEYTAUD (J.). **La question doryphorique au début de la campagne 1930.**—*Rev. Zool. agric.*, xxix, no. 1, pp. 1–19. Bordeaux, 1930.

The situation regarding *Leptinotarsa decemlineata*, Say, on potato in France at the beginning of the 1930 campaign is reviewed [*cf. R.A.E.*, A, xvii, 639]. Further infestations have been discovered, and five new Departments have been invaded. It seems probable that the increase is due to the fact that owing to the particularly favourable hot weather, new infestations discovered in the middle of the summer of 1928 had given rise to adults that migrated. In a few cases, on the other hand, it has been possible to continue the regressive modification of zones begun in 1928. Although the distribution of the beetle has clearly increased, the new isolated foci are not of great importance.

FAVARD (P.). **Le hanneton vert de la vigne.**—*Prog. agric. vitic.*, xciv, no. 28, pp. 37–38. Montpellier, 13th July 1930.

A brief account is given of the bionomics of *Anomala vitis*, F., which has recently become a pest of vines in the south of France [*cf. R.A.E.*, A, xvi, 345]. This Rutelid lives in the sands of the Mediterranean coast, and before the extension of vine-growing during the last century, fed chiefly on *Tamarix* and *Scolymus*. The adults emerge at the end of June and disappear during the last fortnight in July, the males dying and the females burrowing into the ground to lay about 30 eggs at the base of the vine stock. The larvae hatch in August and remain $1\frac{1}{2}$ years in the soil, eventually pupating in May. In addition to the injury caused by the feeding of the adults on the foliage [*loc. cit.*], the larvae gnaw the roots, sometimes at a great depth, and in sandy soil the vines frequently die.

TUTIN (F.). **Further Observations on a Pyrethrum Spray Fluid.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1929*, pp. 93–95. Long Ashton, Bristol [1930].

Further observations have been made on the pyrethrum spray fluid already described [*R.A.E.*, A, xvii, 536 ; xviii, 498]. With somewhat hard water, a rather better emulsion was obtained if the mixture was prepared in the first instance using only 20 gals. water, the remainder being added immediately after the alkali had been thoroughly stirred in. In trials carried out in 1929, it was found that cottonseed oil is

probably rather more satisfactory than rape oil and is also somewhat cheaper. In experiments, the spray has been used again with apparently good effect against the raspberry beetle [*Byturus tomentosus*, F.], *Phyllodecta vulgatissima*, L. (willow beetle), *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) and an Aphid. In the case of mature apple trees infested with *Paratetranychus*, control appeared to be complete and no damage to foliage resulted, whereas on adjacent trees where the mite was controlled with lime-sulphur (1 : 30), considerable scorching occurred on the less hardy varieties.

The material dissolved by ether from pyrethrum flowers that had already been extracted with light petroleum was, at first, found to have distinct insecticidal activity, but after re-extraction with petroleum it was found to be inert. A quantity of the flowers that had been deprived of everything soluble in petroleum or ether was digested with water, but the filtrate obtained gave negative results against sawfly larvae. The flowers that had been successively extracted with petroleum, ether and water were then, after drying, extracted with boiling alcohol, but negative results were obtained with a suspension of the product. It may therefore be concluded that the entire insecticidal value of pyrethrum flowers resides in the petroleum-soluble product. An alcoholic extract of the original flowers contains the active principles in association with a relatively large amount of inert material, the presence of which renders the preparation of a satisfactory spray fluid much more difficult.

Tutin (F.). **Examination of Plants for Insecticidal Principles.—I.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1929*, pp. 96–98, 1 ref. Long Ashton, Bristol [1930].

Tests against Lepidopterous larvae were made with products obtained from *Oenanthe crocata* (water hemlock) and *Inula dysenterica* (fleabane). A rape oil emulsion of the resinous residue obtained on successive extraction of the ground roots of *O. crocata* with alcohol and petroleum was prepared in a manner similar to that used for the emulsification of pyrethrins [*cf. R.A.E.*, A, xvii, 536 ; xviii, 498]. Results obtained with this spray indicate the presence of a principle toxic to insects, and it is hoped to conduct further experiments to ascertain if any practical use can be made of it. The materials obtained from the dried and ground flowers of *I. dysenterica* by extraction with petroleum, alcohol and water possessed no insecticidal properties.

Walton (C. L.) & Staniland (L. N.). **The Common Green Capsid Bug** (*Lygus pabulinus*) **as a Pest of Sugar Beet.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1929*, pp. 99–100, 1 pl. Long Ashton, Bristol [1930].

During June 1929, two outbreaks of *Lygus pabulinus*, L., occurred on sugar-beet, in Lincoln and Somerset. In Somerset, the infestation was limited to a belt 30–40 yards wide extending into the crop from a hedgerow bordering a road, which bounded the field on two sides. Similar injury was apparent in potatoes grown in the rest of the field. Examination of the hedgerow revealed Capsid injury on bramble and bindweed, and there seems little doubt that the infestation originated there, and that the young Capsids after hatching migrated into the field and, weeds being almost absent, attacked the young

beet. The part of the crop that had been sown on 18th April was much less injured than that sown on 13th May, which was severely attacked. On the average, there were three nymphs to each plant. The damage was confined to the young leaf growth, and in many cases where this was almost destroyed, the cotyledons extended abnormally and became much thickened and very brittle. Slight injury also occurred on a small area of sugar-beet on the opposite side of the road. The application of a dust containing nicotine gave satisfactory results, and the affected plants subsequently made good growth.

Staniland (L. N.) & Walton (C. L.). **Experiments on the Control of Pear Midge** (*Contarinia pyrivora*). **Progress Report.**—*Rep. Agric. Hortic. Res. Sta. Bristol* ***1929***, pp. 124–129, 2 refs. Long Ashton, Bristol [1930].

Work on the control of *Contarinia pyrivora*, Riley (pear midge) has been in progress in England and Wales since 1926. The females lay their eggs in the blossoms, often before they open. The feeding of the larvae causes rapid and swollen growth of the fruits, the majority of which eventually fall. Most of the larvae are mature by the beginning of June and pupate just below the surface of the soil, or less usually within the fruitlets.

In further experiments with attractants mixed with banding grease and exposed on boards hung in the trees [*cf. R.A.E.*, A, xv, 615], no reduction in attacked fruitlets was observed even on those trees bearing the more attractive substances, and this method is not considered likely to be of practical value in the control of the midge.

Calcium cyanide applied in June and worked into the soil at the rates of ½, 1 and 2 oz. per sq. yd. to a depth of 4 ins. effected complete control in the case of light garden soil, and when applied to heavy wet soil in October, resulted in considerable reduction in infestation. A rate of ½ oz. per sq. yd. appeared to be the most satisfactory. The removal during the winter of all soil to a depth of 4 ins. from beneath two infested trees resulted in satisfactory control of the midge. Tar distillates applied to the soil beneath infested trees in a grass orchard gave negative results.

In 1928 and 1929 trials were made with a spray of 6 oz. nicotine in 100 gals. water with the requisite amount of soft soap applied to the open blossoms at the rate of 3½ gals. per tree. A marked reduction in attack was observed.

Maynard (J. G.). **The Economics of spraying Fruit Trees. II. The Cost of Summer and Winter Washing, 1929 and 1930.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1929*, pp. 168–175. Long Ashton, Bristol [1930].

Details of the costs of summer and winter spraying for 1929–30 are given and compared with those compiled on the same farm in the previous year [*R.A.E.*, A, xvii, 538]. As the figures for that year indicated that it was more economical, power spraying equipment was used almost exclusively and spray guns were invariably employed in conjunction with it. For the plots discussed, a system of metal mains was adopted where it was necessary to use more than the ordinary lengths of rubber hose pipes. With the exception of one experimental wash, the materials used were ordinary commercial products, such as

lime-sulphur, excess lime Bordeaux mixture, the Long Ashton two-solution winter wash [xvii, 673] and a well-known proprietary winter wash. The main feature of interest is the reduction of cost compared with the previous year. Winter spraying on certain plots in 1928–29 occupied 225¾ spraying hours, whereas in 1929–30 this was reduced to 119¾ spraying hours. The reduction is far greater than can be accounted for by better weather conditions. A considerable proportion of the saving of time was effected by using power equipment. Not only does increased speed bring about a direct financial saving, but it enables a great deal more spraying to be done in suitable weather. The reduction in cost is attributed to a general increase in efficiency rather than to any one special economy. The use of four guns on the machine in place of two reduced the overhead costs, and by doubling the output, reduced the necessity of working under unfavourable conditions. The number of gallons applied from one nozzle in one hour was increased from an average of 50 to approximately 70 gallons by working at slightly greater average pressure, a procedure made possible by the use of better pipe unions, which are described. It was found that about half the "spraying time" was taken up in moving from tree to tree, and it is proposed to examine methods by which it is hoped to reduce this lost time during the coming season. The cost of power sprayers is discussed in detail.

Speyer (E. R.). **Red Spider Investigations.**—*14th Ann. Rep. Exptl. Res. Sta., Nursery Mkt. Gdn. Ind. Devpmt. Soc. 1928,* pp. 76–79. Cheshunt, Herts, 1929. [Recd. 1930.]

In experiments in February adult females of the red spider mite [*Tetranychus telarius*, L.] were placed in a glass tube inserted through a hole in the pane of a heated greenhouse. In the absence of light or in feeble illumination the mites tended to congregate at the junctions of the warm and cold portions of the tube, when the temperature was in the region of 50° F. If placed in the warmth, they moved to a cooler portion of the tube. In the presence of sunlight they became very active, irrespective of the temperature, and were attracted to any part of the tube in the sunlight. Similarly, in glasshouses the hibernating mites tend to climb upwards on sunny days even at freezing temperatures ; they also do so when the pipes are first heated, only descending to the plants when ready to oviposit [*cf. R.A.E.*, A, xvii, 187]. A young cucumber plant, severely infested by this mite, was sprayed with a 1 : 80 emulsion of 81·8 per cent. petroleum, 4·5 per cent. potash soft soap dissolved in 2·2 per cent. amyl alcohol (fusel oil), and 11·5 per cent. distilled water. Eight days later the spray had destroyed all the mites and 92 per cent. of the eggs. Adult females placed on uninfested potted cucumbers 3 days after the plants had been sprayed with the same emulsion did not begin to oviposit for 7 days.

Orchard (O. B.). **Experiments on commercial Nurseries. Red Spider Investigations on commercial Nurseries.**—*14th Ann. Rep. Exptl. Res. Sta., Nursery Mkt. Gdn. Ind. Devpmt. Soc. 1928,* pp. 79–87 ; *15th, 1929,* pp. 60–62. Cheshunt, Herts, 1929–30.

Experiments in cleaning glasshouses before planting, to prevent reinfestation by the red spider mite [*Tetranychus telarius*, L.] [*cf.*

R.A.E., A, xvii, 187], show that the plants become infested much later in houses sprayed with oil emulsions or fumigated with naphthalene, at the rate of 1 lb. to 1,000 cu. ft., than in untreated ones.

Oil emulsions are also recommended for controlling the mite on tomatos and cucumbers. The best results were obtained by spraying at intervals of 3–4 weeks from the time the plants were about 3 months old until the first week in September. During April and May, when growth is luxuriant, as much ventilation as possible should be given when spraying, and the humidity of the house should be reduced for about three days, as oil emulsions tend to conserve the moisture in the foliage.

Experiments show that tomatos are more seriously injured when first infested between the ages of 1 to 2 months, whereas plants attacked when 4 to 6 months old are able to outgrow the injury. Observations indicate that an excess of moisture at the roots of the plants does not render them more susceptible to attack by the mite.

READ (W. H.). **Fumigation Experiments. Fumigation Experiments with the Red Spider Mite.**—*14th Ann. Rep. Exptl. Res. Sta., Nursery Mkt. Gdn. Ind. Devpmt. Soc. 1928*, pp. 87–96 ; *15th, 1929*, pp. 62–65. Cheshunt, Herts, 1929–30.

Further experiments [*cf. R.A.E.*, A, xvii, 406] in which the effect of a number of fumigants was tested on the red spider mite [*Tetranychus telarius*, L.] and upon plants are described. Many of them destroyed all the mites at low or moderate concentrations, but all seriously damaged the plants, with the exception of 2 chloro p-nitrotoluene, which, used at the rate of 2 oz. to 1,000 cu. ft., controlled the mite in 16 hours at 60° F., and caused only slight injury to the plants.

Experiments in the preparation of various mineral oil emulsions for spraying tomatos growing under glass are described. The oils that were toxic to the mite also caused injury to the plants. Several vegetable oils were found to possess slightly greater insecticidal values than the highly refined petroleum oils and are also more easily emulsified. A satisfactory emulsion for immediate use with soft water can be prepared by stirring 100 parts of washed cottonseed oil into 20 parts of a 20 per cent. solution of soft soap until no further thickening of the mixture can be felt. This mixture will control the mite at 1 : 100. Experiments were made with phenols emulsified with soft soap, and tables showing the lowest strengths of the emulsions that will kill the mite, and the highest strengths at which no injury is caused to the foliage, are given.

SPEYER (E. R.). **A White-fly Parasite** (*Encarsia formosa* **Gahan**).—*14th Ann. Rep. Exptl. Res. Sta., Nursery Mkt. Gdn. Ind. Devpmt. Soc. 1928*, pp. 96–100. Cheshunt, Herts, 1929. [Recd. 1930.]

A total of 287,000 individuals of *Encarsia formosa*, Gah., was reared and distributed in various parts of Britain during February–September 1928, for controlling *Trialeurodes vaporariorum*, Westw. In addition to these, 22,000 parasites were sent to the Laboratory of the Imperial Institute of Entomology at Farnham Royal for shipment

to Canada. The methods of breeding and distributing the parasites are described [*cf. R.A.E.*, A, xvii, 257, 406]. In cases of severe infestations of *T. vaporariorum*, fumigating with tetrachlorethane or hydrocyanic acid gas will destroy the adults without affecting the parasites, 5 oz. tetrachlorethane or $\frac{1}{8}$ oz. sodium cyanide with $\frac{1}{2}$ fluid oz. 33 per cent. sulphuric acid being used to 1,000 cu. ft. A table is given, showing the results obtained by different growers from the distribution of the parasites. Complete control was reported in 28 instances, partial in 36 and no result in 3. No case of complete control resulted from consignments of the parasite received after the end of June. Observations made in August and September in several commercial nurseries in which partial control was obtained showed a very high percentage of parasitism in greenhouses where the state of repair was good, and a low percentage (about 33 per cent.) in leaky houses.

SPEYER (E. R.). **Other Glasshouse Pests.**—*14th Ann. Rep. Exptl. Res. Sta., Nursery Mkt. Gdn. Ind. Devpmt. Soc. 1928*, pp. 100–101. Cheshunt, Herts, 1929. [Recd. 1930.]

Control measures adopted in glasshouses against *Diarthronomyia hypogaea*, Lw., on chrysanthemums, especially the removal of all young growth from the base of the plants [*cf. R.A.E.*, A, xvii, 406], appear to have eradicated the midge from nurseries in the Lea Valley district. An outbreak of *Lygus pratensis*, L., occurred early in July on chrysanthemums growing in the open. Further attacks on the foliage and stems were prevented by dusting with flowers of sulphur. Untreated plants showed far more distortion of growth than dusted ones, but the dust did not appear to be directly toxic to this Capsid as it has been found to be to *L. elisus*, Van D., in America [*R.A.E.*, A, xvi, 32]. In an experiment against *Agriotes* sp., powdered ammonium carbonate, at the rate of 4 oz. to 1 sq. yd., was broadcast on the surface of the soil and well watered in. Young tomato plants placed in the soil three days after treatment were scorched by ammonia gas ; on the fourth day, however, it was found possible to replant in the ground, and no plants were killed as a result of attack by the wireworms.

SPEYER (E. R.). **Methods in practical Use for the Control of the more important Animal Pests of Glasshouse Plants.**—*15th Ann. Rep. Exptl. Res. Sta., Nursery Mkt. Gdn. Ind. Devpmt. Soc. 1929*, pp. 54–60. Cheshunt, Herts, 1930.

Much of this information on the control of pests of glasshouse plants in England has already been noticed [*R.A.E.*, A, xiii, 371 ; xvii, 186, etc.].

Since it is unsafe to use petroleum emulsions against *Tetranychus telarius*, L., on carnations and peaches, a spray of 2 oz. potash soft soap and $2\frac{1}{2}$ gals. rain-water, to which 1 oz. potassium sulphide (liver of sulphur) is added immediately before use, is recommended. Over a million individuals of the Chalcid, *Encarsia formosa*, Gah., were reared and distributed during 1929 for the control of *Trialeurodes vaporariorum*, Westw. The parasites will live and breed in the winter, provided that the temperature does not drop below 50° F. For trapping *Polia*

oleracea, L. (tomato moth), a bait of 2 gals. light ale, 10 lb. thick dark treacle and ½ lb. sodium fluoride is recommended. Jars, at least 2 ins. in diameter, containing 3 fluid oz. of the bait, should be suspended from the bottom wires of tomato houses, using at least 8 jars to 150 ft. of house. The dead moths and scum should be removed at frequent intervals, and the bait renewed every month. A spray for use on the plants is prepared by stirring 10 oz. lead arsenate paste with ¼ oz. saponin dissolved in 1 pint water until a thin cream is formed and diluting with 10 gals. water. A first spray should be applied to the upper surface of the leaves three weeks after planting out and a second not less than a month later. The mixture should not be allowed to stand before spraying. In cases of severe infestation in the middle of the season, loosely folded sacks placed between the rows attract the larvae, which should be collected from them at frequent intervals. The destruction of the pupae in the soil during the winter is not advocated, since many of them are often parasitised by the Ichneumonid, *Pimpla instigator*, F. Light-traps in vineries against *Tortrix podana*, Scop., failed to attract any appreciable numbers of females, but jars of bait as used against *P. oleracea* caught numbers that had not oviposited; the jars should be hung up from April to October. Complete control may, however, be obtained by the lead arsenate spray, applied repeatedly for several weeks after the leaves first begin to appear against the young overwintered larvae.

The poison bait of 1 lb. Paris green and 28 lb. dry bran, recommended for controlling woodlice [xiv, 345], will also destroy the millepede, *Orthomorpha gracilis*, Koch, in cucumber beds, and is useful against *Tipula oleracea*, L., which occasionally attacks plants grown under glass. For *Tipula* enough water should be added to make a stiff mash. Tests in nurseries on the control of *Agriotes* spp. on tomatos show that pieces of linseed cattle cake, about 4 ins. square, buried between the rows at a depth of 4 ins. and at intervals of 2 feet shortly before the tomatos are planted out, are more effective than slices of carrot as baits for the larvae. Mangels, cut in half and placed with the cut face downwards will attract the adults, which should be collected every morning during February and March.

The larvae of *Pnyxia scabiei*, Hopk., and *Plastosciara perniciosa*, Edw. (cucumber root flies), which are almost always present in the potting soil, only attack the tap roots and the lower parts of the stems of cucumbers when the soil is allowed to become too dry. Flooding the cucumber beds and, in the case of potted plants, allowing them to stand in water for twelve hours, will destroy the larvae. Temporary outbreaks of *Tyroglyphus dimidiatus*, Herm. (*longior*, Gerv.) on potted cucumbers and those recently planted out are easily controlled by sprinkling grade 16 naphthalene on the paths or borders, at the rate of 3–4 oz. to 1,000 cu. ft. of space, and raising the temperature in the glasshouse for a period of two days. The mites cease to breed in sunlight and heat. *Smynthurus viridis*, L., on cucumbers may be destroyed by a spray similar to that suggested against *P. oleracea*, but containing only 3 lb. lead arsenate paste to 100 gals. water. It does not breed in cucumber houses and has not been recorded in them later than March. *Calocoris norvegicus*, Gmel., which is sometimes introduced into the houses upon staging, occasionally causes severe injury to young cucumber plants. It can be controlled by spraying with an oil emulsion, as recommended against *Tetranychus telarius* [xvii, 187].

Massee (A. M.). **The Fauna of the Weevil "Sack-band."—I.**—*Ann. Mag. Nat. Hist.*, (10) vi, no. 33, pp. 317–320, 1 ref. London, September 1930.

A list is given of insects taken in sacking bands used against *Anthonomus pomorum*, L. [*cf. R.A.E.*, A, xiii, 61], with brief notes on some of them.

Böning (K.). **Ueber eine Blattdeformationskrankheit an Rübe und Spinat.** [On a Leaf Deformation Disease of Beet and Spinach.]—*Z. PflKrankh.*, xl, no. 7, pp. 315–323, 7 figs., 8 refs. Stuttgart, July 1930.

An account is given of a disease recently observed by the author in Germany attacking *Rumex* spp., beet and spinach, and causing symptoms similar to those of other virus diseases in Chenopodiaceae. It was transmitted experimentally by *Aphis rumicis*, L., *A. fabae*, Scop., and *Myzus persicae*, Sulz., from *Rumex* to beet and from beet to beet.

Jancke (O.). **Beitrag zur Kenntnis der geflügelten Blutlausweibchen und ihrer Nachkommen.** [A Contribution to the Knowledge of the alate Females of the Woolly Aphis and of their Progeny.]—*Z. angew. Ent.*, xvi, no. 2, pp. 229–303, 42 figs., 21 refs. Berlin, May 1930.

A detailed account is given of experiments carried out in central Germany on virginoparous and sexuparous alatae of *Eriosoma lanigerum*, Hausm. (woolly apple aphis) [*cf. R.A.E.*, A, xiv, 221]. Sexuales were far more abundant in the progeny of the alatae than parthenogenetic or intermediate forms, which averaged 2·6 and 0·3 per cent. respectively, with maxima of 11·2 and 3·6. Both pure virginoparous alatae and virgino-sexuparous alatae occurred, however, in nearly all the experiments ; these may be of importance in spreading infestation of apple if conditions are favourable.

A predominance of virginoparous alatae in summer [*cf.* xvii, 119] was not observed. Low temperature during the development of the alatae reduces their abundance and also the number of young they produce. After they have matured, 17° C. [62·6° F.] appears to be the optimum for reproduction. As a general rule, high temperatures shorten their lives, and low ones prolong them. Reproduction is completed in one day, and death ensues a day or two later. Observations were carried out on various aspects of the biology of the sexed progeny (which do not feed) and the intermediate forms. Complete development of the latter was not obtained. It was found that it is possible for the sexuales to develop and oviposit in the field, though most of them die without doing so. The eggs, however, have not been observed to survive the winter, and all attempts to infest American elm [*Ulmus americana*] with sexuparae or sexuales were unsuccessful. On the other hand, apple trees were successfully infested by progeny with a long proboscis [xiv, 221] from virginoparous and virgino-sexuparous alatae.

The morphology of all the forms referred to is discussed, and it is pointed out that many important morphological and biological differences exist between the woolly aphis as described by American workers

and the European form. Biological differences include the number of male moults; the absence in America of virginoparous and virgino-sexuparous alatae; the failure of fundatrices to develop on American elm in Europe [*cf.* xvii, 119]; and the failure of attempts to transfer the European Aphid to *Sorbus americana* and *Crataegus crusgalli.* The author inclines to Börner's view that American workers have not been dealing with *E. lanigerum,* but with some other species. It is possible that the European *E. lanigerum* is undergoing transformation from a holocyclical species to an anholocyclical one restricted to apple and related plants, a hypothesis supported by the production of virginoparous alatae.

KUNIKE (G.). **Zur Biologie der kleinen Wachsmotte,** *Achroea grisella* **Fabr.** [The Biology of the small Wax Moth, *Achroia grisella.*]—*Z. angew. Ent.*, xvi, no. 2, pp. 304–356, 25 figs., 26 refs. Berlin, May 1930.

A detailed account is given of laboratory observations on the bionomics of *Achroia grisella,* F. (small wax moth) [*cf. R.A.E.*, A, xviii, 485]. The males live for 23 days on an average, and the females, which only mate once, for 7. The latter usually lay 250–300 eggs; a maximum of 460 was observed. The incubation period varies from 5 days at 30° C. [86° F.] to 22 days at 16° C. [60·8° F.]; hatching does not occur above or below these limits, and eggs kept for several weeks below 16° C. failed to develop. The larvae live in mines in the honeycombs where they feed. Some galleries are made, outside the comb, of wax and excreta, but feeding does not take place in them. The larvae can be fed on peptonised pollen from the bees' storage cells, on the pupal cases of the bees, and on various forms of wax, even such as is recovered from excreta, but that portion of the wax that is soluble in ether but insoluble in water or alcohol is toxic to them. They are capable of resisting temperatures between −1 and +36° C. [30·2 and 96·8° F.]. The egg and adult stages are the ones most affected by temperature. The invasion of a hive by this moth only occurs when the colony is in an unhealthy condition.

It is possible that control might be obtained by introducing into the middle frame of the hive some substance harmful to *Achroia* but harmless to the bees and honey, such as the ether-soluble part of the wax, or by using the scent material of the males as an attractant for trapping, but in any case inspection of the hive and removal of the pests are unavoidable. The disinfection of combs in storage may be effected with any suitable fumigant [*cf. loc. cit.*].

KLEINE (R.). **Beiträge zur Kenntnis der Generationsfrage von** *Oscinis frit* **L.** [Contributions to the Knowledge of the Question of Generations of *Oscinella frit.*]—*Z. angew. Ent.*, xvi, no. 2, pp. 377–381, 1 fig. Berlin, May 1930.

It is usually held that *Oscinella* (*Oscinis*) *frit,* L., has three distinct generations a year, with some overlapping. Experiments in North Germany, however, with oats sown at intervals from April to September and rye from August to October show that oviposition is continuous

as long as suitable food-plants are available, and that a decrease of infestation takes place only when a certain average minimum temperature is reached.

RIPPER (W.). *Rhodophaea suavella* **Zck. auf** *Cotoneaster*.—*Z. angew. Ent.*, xvi, no. 2, pp. 382–387, 4 figs., 5 refs. Berlin, May 1930.

The Pyralid, *Rhodophaea suavella*, Znck., the larva of which is described in detail, is recorded as attacking *Cotoneaster* in Austria. The adults occur in June and July, and the larvae hatch in autumn and pupate in the soil in the following June.

LEUZINGER (H.). **Les vers de la vigne en Valais de 1926 à 1929.**—*Bull. Murith.*, xlvii, pp. 90–123, 12 figs., 10 refs. Sion, 1930.

The author discusses the influence of local conditions on the flight of the vine moths, *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., in Switzerland. Temperature and rain are the chief factors controlling the time and duration of flight, the intensity depending rather on the local situation as regards exposure to wind, sun, etc. For practical control purposes it is therefore necessary to determine, in each region, the situations most favourable to flight.

FAES (H.), STAEHELIN (M.) & BOVEY (P.). **La lutte contre les parasites des arbres fruitiers, insectes et champignons, en 1929.**—*Annu. agric. Suisse*, xxxi, pp. 109–122. Berne, 1930.

During the summers of 1928 and 1929, which were unusually dry and hot in Switzerland, *Cydia pomonella*, L., which is always the most serious pest of apple, had a partial second generation. In a small experiment with Volck oil (2 per cent.), all the eggs treated when almost ready to hatch at the end of August were killed. It is impossible to use arsenicals on fruit trees infested so late in the season. Plums were attacked by *C.* (*Grapholitha*) *funebrana*, Tr., the biology of which is very little known. Trap bands indicated that the larvae descend from the trees between 3rd and 11th September, that is, at the beginning of the gathering of the crop. For Aphids on various fruit trees, the most successful spray was 8 per cent. pyrethrum-soap with the addition of 1 per cent. nicotine.

FAES (H.), STAEHELIN (M.) & BOVEY (P.). **La lutte contre les parasites de la vigne, insectes et champignons, en 1929.**—*Annu. agric. Suisse*, xxxi, pp. 123–133. Berne, 1930.

Grapes were successfully protected from the first generation of the vine moths [*Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff.] in Switzerland in 1929 by the use of Paris green or lead arsenate. Calcium arsenate was much less effective. Volck oil (1½ per cent.), both as an ovicide and as a contact insecticide against the young larvae, gave good results when used against the first generation in three successive treatments. Better results against the eggs of the second

generation were, however, obtained with 1 per cent. nicotine in Bordeaux mixture, applied 7 days and again 14 days after the maximum flight of the moths. Pyrethrum sprays proved good contact insecticides.

[Vukasović] Voukassovitch (P.). **Sur la polyphagie de la cochenille** *Lecanium corni* **L.**—*C.R. Soc. Biol.*, civ, no. 25, pp. 1065–1068. Paris, 18th July 1930.

As a result of a serious outbreak of *Lecanium corni*, Bch., on plum in Jugoslavia, a detailed study of its habits on various food-plants was undertaken. It has one generation a year in the central and western parts of the country, which are the principal plum-growing regions. The first and second stage larvae live on the leaves from June until leaf-fall, and after hibernation continue their development from the following April until June on the ends of the branches. In severely infested orchards young larvae could be found on nearly all the small plants on the ground, as well as on the trees and bushes, usually on the lower surface of the leaves. In the course of the summer the number of larvae on these plants decreased regularly, and few remained in September on plants that had previously been heavily infested. During the second part of their development they have never been observed on the green stalks of annual plants, and although they have been found on various fruit trees and wild trees and bushes, these are relatively little attacked in comparison with plums.

In the laboratory experiments begun about the middle of April with second stage larvae, normal development occurred on such trees as apple, pear, quince, cherry, etc. ; the adults oviposited and second stage larvae were obtained, but hibernation did not take place except on quince. Negative results were obtained on mulberry, lime (*Tilia platyphyllos*), wild rose and oak. Cherry, pear and acacia (*Robinia*) were accepted almost as readily as plum. In experiments with first and second stage larvae, begun in June, a small percentage developed normally up to hibernation on a number of plants, such as mulberry, vine, gooseberry, etc., but on all these plants the larvae died during the winter, except on *Cyperus papyrus*. In the same experiment larvae refused to feed on certain kinds of cactus and aloes, and on such plants as ivy (*Hedera helix*), *Ficus elastica*, *Opuntia vulgaris*, etc., they died before reaching maturity. Thus it appears that *L. corni* may feed on a number of plants, but that many of them do not offer the conditions necessary for hibernation. Moreover, a change in food-plant is usually accompanied by a mortality that increases with the remoteness of the relation of the food-plant to plum.

[Vukasović] Voukassovitch (P.). **Sur certaines variations dans le comportement de la cochenille,** *Lecanium corni* **L.**—*C.R. Soc. Biol.*, civ, no. 25, pp. 1068–1070. Paris, 18th July 1930.

An account is given of an experiment in which *Lecanium corni*, Bch., was reared from June 1928 to April 1930 on *Cyperus papyrus* in a heated laboratory. The change of food-plant from plum was accompanied by a very high mortality. Two variations in the habits of the larvae were observed. In some cases those that would normally have left the leaves in November to hibernate on the branches hibernated

on the leaves, and, in the second generation of the experiment, certain individuals developed rapidly and produced offspring without hibernating.

SCHMITZ (H.). **Phoriden aus Eipaketen von** *Locusta migratoria* **in Daghestan.** [Phorids bred from Egg-pods of *L. migratoria* in Daghestan.]—*Natuurhist. Maandblad,* xix, no. 6, pp. 67–69, 3 figs. Maastricht, 27th June 1930.

Megaselia leucozona, sp. n., *M. aspera,* sp. n., and *M. parvula,* sp. n., are described from adults bred from egg-pods of *Locusta migratoria,* L., in Daghestan.

[GROSSHEĬM (N.).] **Гроссгейм (Н.). A Weevil damaging the Bark of Fruit Trees** (*Magdalis ruficornis* **L.).** [*In Russian.*]—*Visn. Sadiv. Vinogr. Gorodn.,* vi, no. 2–3, pp. 95–105, 10 figs., 20 refs. Kharkov, February–March 1930.

A key is given to the species of *Magdalis* that attack fruit trees in Europe, *viz., ruficornis,* L. (*pruni,* L.), *barbicornis,* Latr., *cerasi,* L., and *armigera,* Geoffr. (*stygia,* Gyll.), and the literature on these weevils is briefly reviewed. Observations were carried out in 1928 and 1929 in the Kiev Government on *M. ruficornis,* which was very abundant on apple, plum, apricot and quince, and caused considerable damage. The eggs, larvae and pupae are briefly described. The adults, which were present from mid-May to mid-July, make round holes in the leaves and small pits in the young bark, which sometimes extend to the wood. The eggs are deposited singly or in groups of about 4 in similar pits made chiefly in the young, green bark covering the wounds left by the removal of large branches, or sometimes at the base of short fruit-bearing twigs, and are covered with excreta. The larvae burrow into the wood in any direction. They probably feed for a month, as about mid-July they enter a diapause in oval cells excavated at the end of the burrows and separated from them by a thick layer of frass, where they remain till the end of the following April, when pupation takes place. The bark of infested branches, which slowly die, splits and becomes loosened, exposing the larvae, which fall out of the cells when the tree is jarred, and might easily be collected and destroyed in this way. The pupal stage lasts 16–17 days, and some days later the weevils make their way out to the surface by cutting exit holes.

Shaking the weevils off the trees during the flight period is strongly recommended ; all dead or dying branches and twigs should be removed in autumn and early spring and burnt. Tits and woodpeckers, which feed on the larvae in winter, should be protected.

[FILIP'EV (I. N.).] **Филипьев (И. Н.).** [Report of the] **Division of Applied Entomology.** [*In Russian.*]—*Ann. Rep. St. Inst. Exptl. Agron.,* 1928–29, pp. 169–198. *Izv. Gosud. Inst. opuitn. Agron.,* 1929, no. 6, suppl. Leningrad, 1930.

The work of the Entomological Division of the State Institute of Experimental Agronomy and the investigations by sub-sections in

various parts of the Russian Union on locusts, *Phylloxera*, and other pests during the year ending 1st October 1929 are reviewed. Parasites reared from the larvae of *Pyrausta nubilalis*, Hb., additional to those already recorded [*R.A.E.*, A, xvii, 220], were *Eulimneria rufifemur*, Thoms., in Daghestan, North Caucasus and Transcaucasia ; *Eulophus* sp. in North Caucasus and Azerbaijan ; *Cremastus* sp. in Transcaucasia ; and 3 unidentified Chalcids in Daghestan. Observations were made on the biology of *Aphidius granarius*, Marsh., and *Ephedrus plagiator*, Nees, as parasites of Aphids, of which the third and fourth instar larvae are preferred. The former species is active in the first half of the summer, and the latter becomes prevalent towards the end of the season. Owing to the activity of hyperparasites, chiefly Cynipids, especially in the second half of July, the percentage of parasitism, which increased from 36 in June to 89 in mid-July, was 64 in August and 76 in September.

Apion aethiops, Hbst., is recorded for the first time as a pest, the larvae injuring the stems of broad beans (*Vicia faba*).

Studies on *Heliothis obsoleta*, F., which is the most important pest of cotton in Daghestan, showed that oviposition occurs in spring on cultivated leguminous plants, and in June–July on maize [xvii, 3]. Cotton is infested from about the second half of July. Preliminary experiments showed that the females may be attracted to, and oviposit on, tassels of cotton yarn soaked in extracts from the maize silk.

[Negrash (K. A.).] **Неграш (К. А.). The Influence of the Time of Sowing of Beet on the Control of the Beetroot Weevil,** *Bothynoderes punctiventris* **Germ.** [*In Russian.*]—*Sborn. S.S.U.*, 1929, no. 8 (16), pp. 69–94. Kiev, 1929. [Recd. 1930.]

A severe outbreak of *Bothynoderes punctiventris*, Germ., occurred in 1928 in the Kiev Government on sugar-beet sown between 13th and 24th April. The meteorological conditions of the year and their influence on the growth of the crop are reviewed. The weevils emerged from hibernation between 12th and 25th April, but owing to cold, rainy weather in May, the mass flight did not take place till the second half of the month. As a result of the unusual abundance of the pest, 71–92 per cent. of the beet had to be resown. In normal years, when the weevil is less numerous, beet sown before 1st May or after 15th May is little damaged by it, but the later time of sowing is less practical economically. Beet sown between 1st and 15th May is the most susceptible to infestation, because the appearance of the shoots coincides with the mass flight of the weevils. This outbreak, however, showed that in years of severe infestation early sowing does not safeguard the beet, and early sown beet offers favourable conditions for the feeding and oviposition of the first groups of weevils that emerge, and may thus be responsible for an increase in their numbers in the following year. Furthermore, the sugar content and crop yield of early sown infested beet was much inferior to that of late-sown infested beet. In years in which heavy outbreaks are probable, preference should, therefore, be given to late sowing, and as the weevils may be best controlled while they are concentrated on beet shoots, trap plots should be sown on fallow land. Experience has shown that outbreaks may be foretold by examination of the soil in September and October and counts of hibernating weevils to a given area.

[Bel'skiĭ (B. I.).] **Бельский (Б. И.). The Application of Insecticides containing Arsenic for the Protection of Seeds and subterranean Parts of Plants.** [*In Russian.*]—*Sborn. S.S.U.*, 1929, no. 8 (16), pp. 95–110, 1 fig., 13 refs. Kiev, 1929. [Recd. 1930.]

Experiments were carried out in and near Kiev in 1925 on the relative effect of Paris green, arsenic trioxide and calcium arsenite on the germination of seeds, the roots of different trees and the larvae of *Melolontha melolontha*, L., and *Polyphylla fullo*, L. Various quantities of the insecticides were added to a mixture of clay, fresh cow-dung and water, each gallon containing 6 lb. clay and 2 lb. dung. In tests of the germination of wheat, maize, peas and beans dipped in the mixture, wheat was the least affected, 62 per cent. germinating when treated with 1 lb. Paris green to 50 gals. of the mixture, as compared with 89 per cent. in the case of arsenic trioxide. The percentages of germination when 1 lb. of poison was used to 10 gals. were 6 with Paris green, 69 with calcium arsenite and 90 with arsenic trioxide.

In pot experiments, roots of trees and beets cut in half were dipped in the mixture and exposed to two-year-old larvae of *M. melolontha*. In 4 cases out of 11 the larvae fed on the treated beet and remained alive; in many cases they removed the poisonous crust from the beet and pushed it away. Arsenic trioxide acted more rapidly than the other insecticides and was the most toxic, the total percentage of the larvae killed in the experiments being 84·4 as compared with 61·8 by Paris green and 25 by calcium arsenite. The number of larvae killed increased in proportion to the increase of the dosages of Paris green (from 1 lb. to 10 lb. per 100 gals.), whereas the opposite occurred in the case of arsenic trioxide. A similar experiment showed that larvae of *P. fullo* may feed on poisoned vine slips without being affected; it is probable that they also first remove the poisonous crust covering the slips.

In field experiments young trees were planted in ground heavily infested with the larvae of *M. melolontha* after their roots had been dipped in the mixture. All three insecticides were injurious to the trees, 89·7 per cent. being killed by Paris green, 57·6 per cent. by arsenic trioxide, and 40 per cent. by calcium arsenite. In the case of Paris green the percentage of the treated trees killed was considerably higher than that of the untreated ones killed by the larvae, but arsenic trioxide was sometimes beneficial. Examination of the roots showed that in many cases the larvae fed on those treated with Paris green, but seldom attacked those poisoned with arsenic trioxide.

It therefore appears that Paris green damages plants and does not protect them from *M. melolontha* and *P. fullo*. Arsenic trioxide at the rate of 1 lb. or less to 200 gals. of the mixture is harmless to certain trees, but does not necessarily protect them against *Melolontha*, though it is more effective than Paris green. Calcium arsenite is probably less toxic than either Paris green or arsenic trioxide.

[Lyubomudrov (I. S.).] **Любомудров (И. С.). The Infestation of Granaries with Pests of stored Products in the Podolsk Section of the Sugar Trust.** [*In Russian.*]—*Sborn. S.S.U.*, 1929, no. 8 (16), pp. 133–141. Kiev, 1929. [Recd. 1930.]

Warehouses in the Podolsk Government in which grain and other seeds were stored were found in 1925–26 to be severely infested by the

usual pests of stored products. Their distribution in different districts of the Government is discussed, and the percentage of infestation of each product is shown in a table.

[KASHEVAROVA (A. A.).] **Кашеварова (А. А.). The Infestation with Wireworms of the Fields belonging to the Sugar Refineries of the Kursk Section, 1925-1928.** [*In Russian.*]—*Sborn. S.S.U.*, 1929, no. 8 (16), pp. 143–148, 3 diagr. Kiev, 1929. [Recd. 1930.]

Examinations of the soil of cultivated fields in the Kursk Government carried out from 1925 to 1928 showed that various species of Elaterids, a list of which is given, were the most numerous of the subterranean pests. Their relative abundance in each year is indicated in diagrams and their distribution within the Government is discussed.

[LESOVOĬ (D. I.).] **Лесовой (Д. И.). The Breeding of Hymenopterous Egg-parasites of injurious Lepidoptera.** [*In Russian.*]—*Sborn. S.S.U.*, 1929, no. 8 (16), pp. 181–189. Kiev, 1929. [Recd. 1930.]

This paper, written in 1915 but hitherto unpublished, is an account of experiments carried out by the late author in Kiev in 1913 and 1914 on breeding *Trichogramma evanescens*, Westw. (*Pentarthron semblidis*, Auriv.) in the eggs of various Lepidoptera. The technique of the work is described. When it was necessary to retard the development of the parasites, the infested eggs were placed in a refrigerator on the fifth or sixth day of a normal ten-day development period. They were wrapped in cotton wool and put in perforated tins containing damp moss. The eggs could thus be preserved for months and on removal from the refrigerator gave rise to parasites in about 5 days. Prolonged exposure to cold, however, greatly decreased the vitality of the latter. Of parasitised eggs of *Barathra* (*Mamestra*) *brassicae*, L., kept in the refrigerator for over 3 months, only 45 per cent. produced parasites, the percentage falling to 15 and 2 after exposures of 4 and 4½ months respectively. The resulting parasites were also very weak and unable to oviposit [*R.A.E.*, A, xviii, 589-590]. In these eggs no parasites survived over 4½ months, but in eggs with a rather thick chorion, such as those of *Phalera bucephala*, L., they were more resistant and could be kept in cold storage for six months.

[FEDOROV (S.).] **Федоров (С.). The Outbreak of** *Cydia pomonella*, **L., in the Orchards of the Crimea in 1929 and an Attempt to explain it.** [*In Russian.*]—*Visn. Sadiv. Vinogr. Gorodn.*, vi, no. 1, pp. 11–14, 2 refs., 1 graph. Kharkov, January 1930.

Observations on *Cydia pomonella*, L., carried out in the southern Crimea in 1929, when an unusually serious outbreak occurred on apples and pears, showed that there were three generations, though a number of the larvae of the second hibernated. The first moths were on the wing by the end of May, and pupation and emergence of the first generation took place in July. The second generation larvae were abundant throughout August. Most of those in the laboratory transformed, but others hibernated. Numerous hibernating larvae, probably those of the third generation, were found in October in trap bands in the orchards. The abundance of rainfall and moisture during

the preceding winter and the extreme drought in May–July were very favourable for the development of the moth. This, together with the scarcity of parasites in 1929, was to a great extent responsible for the outbreak. On the other hand, the usual sprays of Paris green were ineffective, as their application did not coincide with the appearance of the various generations in 1929. Properly timed spraying and banding would have considerably reduced the infestation.

[Pospelov (V. P.).] **Поспелов (В. П.). Intracellular Symbiosis and its Relation to Insect Diseases.** [*In Russian.*]—*Ann. St. Inst. Exptl. Agron.*, vii, no. 6, pp. 551–568, 9 figs., 19 refs. Leningrad, 1929. [Recd. 1930.]

This is a review of the literature on symbiotic micro-organisms occurring in insects and the diseases of the latter sometimes caused by them. The symbionts, which are in most cases transmitted through the eggs, usually perform a series of physiological functions in the organism of the host, and only become injurious to it under abnormal conditions.

[Yatzentkovskiĭ (E.).] **Я[центковский] (Е.). On *Schistocerca* in Central Asia.** [*In Russian.*]—*Ann. St. Inst. Exptl. Agron.*, vii, no. 6, p. 692. Leningrad, 1929. [Recd. 1930.]

Schistocerca gregaria, Forsk., invaded Central Asia in the summer of 1929. It was found to be subject to both pure bacterial and mixed bacterial-fungous infections, which may have played a part in the extermination of the invading swarms. Some 400 samples of bacteria and fungi were collected and are now being studied.

Nguyên-cong-Tiêu. **Trois insectes parasites des plantes cultivées.**—*Bull. écon. Indochine*, xxxiii, pp. 351B–360B, 3 figs. Hanoi, April 1930.

Injury to the foliage of *Eugenia operculata* observed in 1924 in Tonkin was found to be due to *Apoderus bilineatus*, F., all stages of which are described. The weevil rolls itself in a piece of the leaf, which it almost cuts off from the remainder, leaving only a narrow connecting strip. The roll eventually dries up completely. During these activities the female lays 2 eggs about 5 mm. apart, so that they are eventually situated in about the centre of the roll on which the larvae feed. Other plants attacked are mango (*Mangifera indica*), *Bischofia javanica* and *Euphoria longana*, but the damage to *Eugenia* is the most important as its leaves are used as a substitute for tea. The only means of restricting the injury would be to cut off and burn all the rolled leaves.

Damage to rice in the Province of Hadong in 1924 was found to be due mainly to the larvae of a Tipulid and another Dipteron, the larval, pupal and adult stages of which are briefly described.* The average loss has been estimated at 10 per cent. among hard varieties of rice, which seem more or less immune, and 65 per cent. among

* The legends of the figures relating to these two pests have been reversed.—Ed.

soft varieties, which in some cases were almost completely destroyed. Rice-fields in proximity to dwellings surrounded by bamboo hedges, or roads bordered with somewhat high grasses appear to suffer most severely. The fields are flooded during 5 months of the year, the water reaching to a depth of 16 ft., so that almost all plants are destroyed. Rice that had appeared healthy in January began to grow yellow and dried up during March, gradually rotting in the water. On examination, some of the stalks were found to contain larvae of *Sesamia inferens*, Wlk., and *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), but most of them were attacked by the two species of Diptera. Laboratory experiments showed that these larvae are unable to penetrate the stem directly, but secure an entrance through the internal parts of the leaf-sheath, boring subsequently through the cells of the parenchyma and severing the growing woody tissues.

When mature, the larvae of the Tipulid move to the unsubmerged parts of the leaf-sheath, where they form cocoons from decayed vegetable matter, in which they pupate. The larvae of the other fly, which also occurred on *Panicum crus-galli* in infested rice-fields, pupate on submerged portions of the stem or leaf-sheath, or sometimes inside the latter. As both these pests are aquatic in their habits and both show a preference for soft varieties of rice, they might be checked by intermittent draining of the rice-fields and by the gradual substitution of hard varieties. The removal and destruction by burying of infested plants is also recommended.

Simmonds (H. W.). **Problems in Biological Control. The Gap in the Sequence of Generations in** *Artona catoxantha*, **the Coconut Leaf Moth of Malaya.**—*Trop. Agriculture*, vii, no. 8, pp. 215–219. Trinidad, August 1930.

These observations were made in the course of investigations on the parasites of *Artona catoxantha*, Hmps., which attacks several varieties of palms in the East Indies, with a view to utilising them for the control of *Levuana iridescens*, B.B., in Fiji.

A historical account is given of the latter moth, which was first definitely recorded on the islands in 1877, and previous investigations on its control are briefly discussed [*R.A.E.*, A, xviii, 510, etc.]. Although it has never been found elsewhere than in Fiji and no other species belonging to the genus is known, reasons are given for thinking that it was probably introduced from outside.

The observations on *A. catoxantha* were carried out during a major outbreak of this moth near Kuala Lumpur, Malay States. The outbreak was confined to a few acres, and although the palms in the centre of this area were completely destroyed, those at a distance of about 100 yards were not injured. A most remarkable feature of such outbreaks was that all the insects present at a given time were within a certain age limit of each other, and it was impossible at any one time to find all the stages of the moth. The maximum difference in age between the oldest and the youngest individual at any time was 20 days, leaving about 16 days unrepresented. There was always a definite gap in the sequence of generations, and this gap is apparently always present in epidemic outbreaks. The possible variation in the time of development of moths from any batch of eggs is from 34 to 45 days [xiii, 359], indicating that the descendants of any one batch

of eggs should overlap in three or four generations, and all stages be present at any one time, as was the case in Fiji with *L. iridescens*. This does not, however, apparently occur in the case of *A. catoxantha*, and generation after generation continues with a well-marked gap in their sequence, representing a period of about 15 days. The moth is ready to oviposit 35–38 days after having itself commenced its existence as an egg, so that the first eggs giving rise to a new generation would be expected to appear about 35 days after the first eggs of the preceding one. It was 45–46 days, however, before the next generation began to appear.

Observations showed that of the 12–14 different parasites present in these outbreaks, the Tachinid, *Ptychomyia remota*, Aldr., was always the dominant one, although in this particular outbreak a species of *Apanteles* was numerous in the earlier generations. The latter subsequently grew scarcer, and all other parasites tended to die out as the generations progressed, leaving *P. remota* more dominant than ever. In Java, another Tachinid, *Degeeria albiceps*, Macq., is the dominant species and has a very similar life-history.

It seems probable that the inter-relation between the dominant parasite and its host is the cause of the gap in the sequence of the generations, and this opinion is based on the following facts: *P. remota* requires 19 or 20 and *A. catoxantha* 35 or 36 days to complete a life-cycle from egg to egg. *P. remota* and its host emerge, as adults, at approximately the same time; the parasite, however, requires fourth instar larvae on which to oviposit, that is larvae that arise from eggs deposited 16–20 days previously. In consequence, the parasites of the larvae from any one batch of eggs must either find an earlier generation of larvae old enough for parasitism or scatter to find alternative hosts, or failing this, they must wait until the offspring of their own generation of hosts are sufficiently large for their purpose. This latter they are quite capable of doing, but they are then so eager to oviposit that they waste their eggs by placing several upon single larvae, which are each capable of supporting only one parasite, and then have no eggs left for the larvae that mature later. These latter escape entirely, producing another brood of moths, which, however, owing to the total suppression of those larvae that first reached the fourth instar, will appear 6–8 days later than the normal life-cycle of the moth (35 days) would lead one to expect. Also, it follows that 19 days after the first fourth stage *Artona* larva is parasitised, a new brood of parasites will begin to be on the wing ready to suppress any stragglers of their own generation of hosts that may still be about, and the brood of moths is thus cut off at both ends and kept within a period of about 19–20 days. It would also happen that, once this gap is established, any other parasite, the attacks of which are confined, as they mostly are, to a certain stage of their hosts, would also be faced with a long waiting period on the wing, and those surviving this period would immediately attack the first of the next generation to reach the required stage, accentuating still further this gap. Once this gap is established, *P. remota* will tend to maintain it indefinitely, and since the presence of the gap means the escape of a large number of the host there grows up a population of both moths and parasites, the latter never overtaking their host, and an epidemic outbreak occurs.

P. remota, when introduced into Fiji, spread rapidly and in 12–15 months completely cleared up *Levuana iridescens* everywhere except

in three localities, where a gap in the sequence of generations appeared, similar in every way to that in the case of *A. catoxantha.* As with *Artona,* the earlier members of each brood were suppressed, and there was a similar extension of the time from the first eggs in any brood to the first eggs of the next. These were all localities where no alternative parasites of the Tachinid were likely to occur.

In Malaya the advent of the wet monsoon always terminates an outbreak, though it is uncertain in what manner. Fungi undoubtedly play an important part, as well as the mechanical effect of rain. In Java, however, advantage is taken of the gap between the generations to bring an outbreak to a close artificially. This is done by cutting and burning the leaves from the affected palms at the time when the dominant parasite is on the wing, this being when most of the hosts are in the egg or larval stages. In this way a disproportionately large number of parasites is left, and these swamp the comparatively few larvae that have escaped the removal of the foliage.

New South Wales: Proclamation under Plant Diseases Act, 1924.—*Govt. Gaz. N.S.W.*, no. 102, reprint 1 p. Sydney, 1st August 1930.

This proclamation, which revokes that of 17th July 1925 [*R.A.E.*, A, xiii, 639], comprises a revised list of the insects declared to be pests for the purposes of the Plant Diseases Act, 1924 [xiii, 227].

GOURLAY (E. S.). **The Apple-seed Chalcidoid Wasp** (*Syntomaspis druparum*, **Boheman**). **Its Occurrence in New Zealand.**—*N.Z. J. Sci. Tech.*, xii, no. 1, pp. 61–62. Wellington, N.Z., June 1930.

Syntomaspis druparum, Boh. (apple-seed Chalcid) does not attack cultivated apples in New Zealand, and crab-apples, which are favourite food-plants in other countries, have not been examined for its presence, but it oviposits freely in the seed of hawthorn (*Crataegus oxyacantha*) and cockspur thorn (*C. crus-galli*). The adults appear early in December and oviposit throughout the month. The manner of oviposition on hawthorn seed is fully described.

HORI (M.). **The Woolly Apple Aphis in Hokkaido, with special reference to its Control.** [*In Japanese.*]—*Rep. Hokkaido Agric. Expt. Sta.*, no. 24, pp. 35–63. Sapporo, January 1930.

The woolly apple aphis, *Eriosoma lanigerum*, Hausm., which was introduced into Hokkaido more than 50 years ago, is now distributed throughout the Island, causing serious damage to most varieties of apple. It also occurs on *Pyrus* (*Malus*) *sieboldii* and *Crataegus cuneata.* No sexual forms have been observed and no migration to *Ulmus* occurs. The young Aphids hibernate on the trunk or larger branches of apple and mature about the end of May. There are 6–10 generations a year, winged forms appearing from September to October. Development requires 7–21 days, and adult life lasts 22–52, during which time 70–100 young are produced. Birds are sometimes responsible for carrying the larvae to other trees. Natural enemies include the Coccinellids, *Coccinella septempunctata*, L., *Chilocorus similis*, Rossi, *C. rubidus*,

Hope, and *Scymnus hilaris*, Motsch., *Chrysopa septempunctata cognata*, McLach., *Syrphus* (*Episyrphus*) *balteatus*, DeG., and a spider, but no parasitic Hymenoptera have been observed. The usual control methods are recommended.

YUASA (H.) & ONOE (T.). *Ptilineurus marmoratus*, **Reitter, an Anobiid Beetle injurious to Rush Mats, with a Description of a new parasitic Bethylid.** [*In Japanese.*]—*J. Imp. Agric. Expt. Sta.*, i, no. 3, pp. 215–230, 5 pls., 17 refs. Tokyo, 1930. (With a Summary in English.)

Ptilineurus marmoratus, Reitt., which has one generation a year, is distributed throughout the southern half of the mainland of Japan and attacks Japanese rush mats, sometimes causing serious damage. The adults occur from mid-May to early autumn, emergence being at its height in August, and are active on fine, hot days. The eggs are laid singly in crevices in the mats, and the larvae, which may be found throughout the year, mine in the rush. They pupate in their galleries in spring or early summer. A Bethylid, *Sclerodermus nipponicus*, sp. n., which is described by Yuasa, is parasitic in the pupae; the adults sometimes attack man, causing painful swellings on the skin. The measures recommended against *P. marmoratus* are spraying infested mats with 1 per cent. nicotine solution alone or combined with carbon tetrachloride; and spraying the floor with nicotine sulphate, 1 : 800, or dusting it with paradichlorobenzene before laying the mats.

HARUKAWA (C.) & NOSHIRO (S.). *Dolerus harukawai*, **Waters., a Pest of** *Cyperus*. [*In Japanese.*]—*Nogaku Kenkyu*, xv, pp. 148–174, 6 figs. Kurashiki, 1930.

Dolerus harukawai, Wtrst., a sawfly attacking *Cyperus*, has one generation a year in the northern part of Kiushiu, hibernation occurring in the pupal stage in the soil. The adults emerge at the end of April and live for 11–26 days, the females, which greatly outnumber the males, laying 70–80 eggs. The larvae hatch in about 17 days at 13° C. [55·4° F.], and mature in about 40 days. They enter the soil in June, and pupate at the end of October.

MARUMO (N.). **On a Pyralid on** *Zizania latifolia*. [*In Japanese.*]—*Oyo-Dobuts.-Zasshi*, ii, pp. 91–95, 3 figs. Tokyo, 1930.

Zizania latifolia is recorded as a food-plant of *Chilo simplex*, Butl., in Japan.

MARUMO (N.). **On a Method of controlling White Grubs in Lawns.** [*In Japanese.*]—*Oyo-Dobuts.-Zasshi*, ii, p. 140. Tokyo, 1930.

An emulsion of 250 cc. chloropicrin, 160 cc. water and 7·5 gms. soap, used at the rate of 150 cc. in 180 litres of water over an area of 10 sq. metres, killed Lamellicorn larvae in lawns but injured the grass.

KAMITO (S.) & SAKAI (K.). **On** *Bruchus rufimanus*, **Boh.** [*In Japanese.*]—*Oyo-Dobuts.-Zasshi*, ii, pp. 142–144. Tokyo, 1930.

Bruchus rufimanus, Boh., which was found for the first time in Japan in 1926, is now distributed throughout Kiushiu and the southern part of Hondo [*cf. R.A.E.*, A, xvii, 566]. It is very injurious to broad beans, one larva being usually found in each bean, though occasionally as many as eleven may occur. Mortality increases with the number of individuals in the bean. The adults become active when the temperature is above 15° C. [59° F.] and appear to be dormant when it falls below 10° C. [50° F.].

KAWADA (A.). **The Species allied to and Distribution of** *Chilo simplex*, **Butl.** [*In Japanese.*]—*Oyo-Dobuts.-Zasshi*, ii, pp. 145–146. Tokyo, 1930.

Chilo oryzae, Fletcher, is considered a synonym of *C. simplex*, Butl., *C. zonellus*, Swinhoe, being distinct [*cf. R.A.E.*, A, xvi, 358].

ISHII (T.). **The Parasites of** *Chilo simplex*, **Butl., and** *Schoenobius bipunctifer*, **Wlk.** (*incertellus*, **Wlk.**) **in the Southern Islands.** [*In Japanese.*]—*Oyo-Dobuts.-Zasshi*, ii, pp. 148–149. Tokyo, 1930.

Trichogramma sp. and *Spathius* sp. are parasitic in the eggs and larvae respectively of *Chilo simplex*, Butl., in the Philippines, and several attempts have been made to introduce them into Japan.

CUNNINGHAM (H. S.). **Report of the Plant Pathologist, 1929.**—*Rep. Dept. Agric. Bermuda 1929*, pp. 26–31. Hamilton, 1930.

The Mediterranean fruit-fly [*Ceratitis capitata*, Wied.] is a serious pest of fruit in Bermuda. An effort is being made to determine the native host-fruits, as these are evidently more numerous than has been supposed. In the year under review early-sown beets suffered severely from attacks of the Noctuid, *Xylomyges eridania*, Cram., which can be controlled by lead arsenate if applied early enough. The larvae of *Pieris rapae*, L., were very injurious to cabbages. Celery in seed beds was badly damaged by *Lygus pratensis*, L., during December. The greatest hindrance to successful culture of *Citrus* is the Coccid, *Lepidosaphes beckii*, Newm., which, however, can be controlled by thorough and systematic spraying. *Thrips tabaci*, Lind., was very injurious on onions during April. Infestation of palmetto [*Sabal blackburnianum*] by *Comstockiella sabalis*, Comst., did not apparently spread any further during the year. Parasitised scales have been collected, but whether the parasite is the one recently introduced [*R.A.E.*, A, xvii, 562] has not been determined.

EDWARDS (W. H.). **Report of the Entomologist.**—*Ann. Rep. Dept. Agric. Jamaica 1929*, pp. 22–23. Kingston, 1930.

Serious damage by *Cosmopolites sordidus*, Germ. (banana borer) in Jamaica was only found in a few banana plantations where clean cultivation and the destruction of breeding-places had not been carried

out. In experiments to find a practical method of destroying it inside the tissues of suckers intended for plantations, neither fumigation with carbon bisulphide or hydrocyanic acid gas (under atmospheric pressure and during various lengths of time) nor submersion of infested suckers for periods of up to two hours in water containing dissolved HCN gave satisfactory results. No individuals of the Histerid, *Plaesius javanus*, Er., imported from Java, were found in the localities where they had been liberated in 1918–19.

Brief notes on the pests of other economic crops in Jamaica include records of the Bostrychid, *Amphicerus terebrans*, Pall., and the Prionid, *Derancistrus lineatus*, L., infesting branches of coffee, and the Sphingid, *Erinnyis alope*, Dru., defoliating papaya [*Carica papaya*].

SIMMONDS (H. W.). **Mission to Trinidad—Introduction of** *Liothrips urichi*.—*Agric. J. Fiji*, iii, no. 2, pp. 55–67. Suva, 1930.

A brief account is given of the author's visit to Trinidad, beginning in October 1929, as a result of which a large consignment of *Liothrips urichi*, Karny [*cf. R.A.E.*, A, xvi, 602] was sent to Fiji in February 1930 to control *Clidemia hirta*, 3,400 adults being released in the field in March. The methods of breeding, transporting and releasing the thrips are described. It was found to be attacked by a number of natural enemies in Trinidad, including the larvae of a Cecidomyiid, which probably destroyed 30–40 per cent. of the nymphs, the Chalcid, *Tetrastichus thripophonus*, Wtrst., a mite and predacious Rhynchota. The author discusses the other natural factors affecting *C. hirta* in Trinidad, and considers that the effect of *L. urichi* in destroying the seeds may have been overestimated, because the same scarcity of seeds was observed in plants growing in wet districts or under shade, on which it was rare or absent, and in other species of *Clidemia*, which are not infested by it. The seeds were found to be attacked by a number of other insect enemies, including a Chalcid, which sometimes infested as many as 95 per cent. of the fully grown berries, and various Lepidoptera, which feed either internally or externally. Several leaf-feeding insects were observed, but it would not be safe to introduce these into another country.

A brief visit was also made to British Guiana, from which country *C. hirta* is supposed to have been introduced into Fiji before 1890. The form of *C. hirta* found there more closely resembles the Fijian one than that of Trinidad, but this may be due to soil conditions. A thrips similar to *L. urichi* occurred on it in small numbers.

SIMMONDS (H. W.). **Entomological Notes.**—*Agric. J. Fiji*, iii, no. 2, p. 82. Suva, 1930.

The consignment of *Liothrips urichi*, Karny, from Trinidad [see preceding paper] reached Fiji on 13th March, and in the course of a week 5,000 adults were obtained from it. About half of these were kept in cages in order to breed a large supply of the thrips.

Teleonemia lantanae, Dist. [*R.A.E.*, A, xvii, 564] is now well established in the Suva District. It has caused a yellowing of the foliage of *Lantana*, combined with a failure to produce flowers or set seed, over considerable areas and in some places has defoliated the plants.

Taylor (T. H. C.). **Biological Control of Spathe-borer, Coconut Scale and Koster's Curse.**—*Agric. J. Fiji*, iii, no. 2, pp. 83–84. Suva, 1930.

Apanteles tirathabae, Wlkn., which was imported into Fiji from Java in March 1930 to control the coconut pest, *Tirathaba trichogramma*, Meyr., is being reared in large numbers in captivity, and three colonies were liberated in April. In Java its hosts are *T. rufivena*, Wlk., and *T. mundella*, Wlk., and although *T. trichogramma* is not present there, it readily attacks it. It oviposits in the young caterpillars, and the resulting larvae feed internally, killing them after about 10 days. An inspection in April 1930 revealed that the Coccinellid, *Cryptognatha nodiceps*, Mshl., imported from Trinidad, has in all districts caused the complete disappearance of the coconut scale, *Aspidiotus destructor*, Sign., within a year from the time of its liberation [*cf. R.A.E.*, A, xvii, 734]. Notes are given on *Liothrips urichi*, Karny [see preceding papers]. Although this thrips will undoubtedly become established in Fiji, it will probably be years before *Clidemia hirta* can be entirely destroyed, and it is impossible to predict whether appreciable control can ever be attained by this means.

Blackie (W. J.). **Preservation of Books in the Tropics.**—*Agric. J. Fiji*, iii, no. 2, pp. 84–85. Suva, 1930.

In order to minimise the serious damage caused to books and documents by insects and moulds in the tropics, the bookcases must have closely fitting glass doors and contain the vapour of some volatile chemical deterrent, and the books should be treated with a suitable protective poisonous material.

The following procedure has been recently adopted with success in Fiji. The books are fumigated with hydrocyanic acid gas, and a solution containing 1 oz. mercury bichloride, $1\frac{1}{2}$ oz. carbolic acid and 1 quart methylated spirits containing pyridene as one of the denaturing agents is painted on both sides of the covers and generously along the seams dividing the covers from the printed material. This solution must be stirred continually, as the mercury bichloride has a tendency to settle out. After it has dried, a varnish containing 1 oz. shellac dissolved in 8 oz. methylated spirits, to which has been added 3 drms. creosote oil, is painted on in the same manner, a small amount being added to the extremities of the pages, while the books are closed. The shelves of the bookcase are similarly treated and porcelain dishes containing paradichlorobenzene are placed on them. Holes drilled in the shelves at regular intervals to hold containers for paradichlorobenzene would be preferable. Cardboard boxes in which papers are stored should be treated inside and outside with both solutions, and an envelope containing paradichlorobenzene should be placed in the box or fixed inside the lid. This treatment once a year should be sufficient, but this has not yet been proved.

Taylor (T. H. C.). **Early Nutfall from Coconut Palms in Fiji, with special reference to Insects attacking the Flowers.**—*Bull. Dept. Agric. Fiji*, no. 17, 42 pp. Suva, 1930. Price 2*s*. 6*d*.

Insects are responsible for a very large proportion of the abnormal premature nutfall of coconuts that occurs each year in Fiji, almost all

the damage in this respect being due to the Pyralid, *Tirathaba trichogramma*, Meyr. Other insects that injure the flowers or young fruit include the Curculionid, *Diocalandra taitensis*, Guér., which feeds on, and breeds in, any part of the palm that has been injured by other causes and has begun to decay ; the Cossid, *Acritocera negligens*, Butl., which attacks quite 50 per cent. of the coconut palms in Fiji, making round holes in the spathe and causing the flower branchlets to turn black in irregular patches ; and three unidentified Tineids. An account is given of the bionomics of the five moths, and all their stages are described.

Tirathaba trichogramma is present uniformly throughout Fiji and occurs on almost every coconut palm. The eggs, which are very difficult to find, are frequently laid in (not on) the stout fibrous sheaths that surround the bases of the leaves and spathes, and sometimes between adjacent flower-buds or inside male flowers ; they are generally in irregular batches of from 2 to 15. After an incubation period of 5½–6 days, the newly hatched larvae wander if food is not immediately available. Their food consists essentially of the flowers, and if no flowers are open they usually bore into a male flower bud. They may also be found feeding on decaying flowers heaped round the base of a leaf, but experiments show that they mature sooner on healthy flowers. Many migrate later from the bases of the leaves to the flower-branches. The larvae are concealed in all stages, and, even in the buds, and particularly along the stems or between flowers, they construct long silken tunnels, covered with frass and bits of flowers, leaving these only at night. A larva that has bored into a female flower closes its entrance hole with a web packed with frass and lives within the flower until it is entirely moist and decayed. Such flowers frequently fall with the full-grown larvae inside them, or just after the larvae have left them for pupation. The larvae among dead flowers probably attack each other, as they do in confinement. The larva is incapable of boring into the spathe ; *A. negligens* is the only species that can do this. The cocoon is spun of chestnut-brown silk and is covered with bits of flowers and fibre ; it is generally placed on the sheaths round the bases of the leaves and spathes, but may occur in many other situations. Pupation takes place about three days afterwards. Larvae under favourable conditions develop in about 20 days and about 14 are spent in the cocoon, though these periods may be varied according to the food they find ; in general, the life-cycle from egg to adult may occupy 39–53 days.

The author has attempted to determine numerically the amount of nutfall due to *T. trichogramma*, and calculates that the percentage of increase in production that would result from extermination of this moth is 31·76, which he estimates as being worth £126,000, valuing copra at £14 per ton. The percentage of increase in nutfall resulting from the presence of the Pyralid is estimated at 8·8.

Parasites are of little value in the control of this moth, though three species were observed, *viz.*, an egg parasite, probably *Trichogramma* sp., which attacks any Lepidopterous egg with a sufficiently thin shell ; a Braconid destroying up to 10 per cent. of the larvae, which has a life-cycle of 18 days and frequently does not kill the host larva until a few days after emergence from it ; and an Ichneumonid, which parasitises about 3 per cent. of the pupae. Predators may be more valuable than these parasites, though data on this subject are difficult to collect.

BROMLEY (S. W.). **Bee-killing Robber Flies.**—*J. N. Y. Ent. Soc.*, xxxviii, no. 2, pp. 159–176, 1 pl., 31 refs. New York, N.Y., June 1930.

Records of Asilids feeding on honey bees in various parts of the world are briefly reviewed. In North America, *Promachus fitchi*, O.S., and in Argentina, *Mallophora ruficauda*, Wied., have been recorded as causing losses to bee-keepers. In the United States five genera, *Stenopogon*, *Deromyia*, *Promachus*, *Mallophora* and *Proctacanthus*, contain species that commmonly kill bees, and species of *Bombomima* and *Erax* occasionally do so. Economic losses are caused only when the flies are very abundant in the close vicinity of the apiary, *P. fitchi* being the only species in the United States for which these conditions would be likely to obtain. As this fly would occur in fields heavily infested with *Lachnosterna* (*Phyllophaga*) *fusca*, Froel., or other white grubs, on which the larvae commonly feed, it might be controlled by grazing pigs on the field, as these animals would feed on the larvae of both. Autumn ploughing of infested fields is also suggested as a method of control.

WOGLUM (R. S.), LAFOLLETTE (J. R.), LANDON (W. E.) & LEWIS (H. C.). **Handbook of Citrus Insect Control for 1930.**—*Bull. California Fruit Gr. Exch.*, no. 7, 45 pp., 1 chart. Los Angeles, Cal., July 1930.

This report deals in detail with the measures employed during the season 1929–30 against insects attacking *Citrus* under the various conditions prevailing in 14 fruit-growing districts of California. The characteristics of 37 proprietary oil sprays used are tabulated [*cf. R.A.E.*, A, xvii, 663], and a chart shows the percentage of spray oils distilled at different temperatures, notes on their effectiveness being included. After the use of medium oil sprays on orange trees over a period of 5 years, no conclusive evidence has been produced that their continued employment will ultimately lead to general decline in the condition of the trees. There is evidence, however, though as yet inconclusive, that the heavier oils will produce a decline in orange trees by long continued application. Dead wood is the most permanent effect easily noticeable. Most of the other deleterious effects constituting serious drawbacks to the unrestricted use of oil sprays can be entirely eliminated or at least reduced to within the range of commercial practicability by particular attention to the type of oil used, a restricted season and proper applications [*cf.* xviii, 171].

From the standpoint of the trees there is no doubt that fumigation, if it will control the insects, is preferable to oil sprays, but there are districts where fumigation fails and oil sprays are preferable in spite of the risk connected with their use.

The following restrictions will render the use of oil sprays on *Citrus* comparatively safe : The use of the most volatile oil consistent with control of Coccids and red spider [*Paratetranychus citri*, McG.] ; restricting the period of application to 15th July–15th September where possible ; and the avoidance of spraying in hot weather above 90° F., and on trees suffering from lack of moisture or recently sprayed or dusted with sulphur. Heavy oils should not be used on oranges. Where there is a danger of rot, lime-sulphur should be mixed with the oil from November to January, but an old crop of fruit should not be sprayed. Lemons should be sprayed from July to October, but

applications should not be made when the main crop is ¾ in. or less in diameter [*cf.* xviii, 171]. In interior areas, lime-sulphur and oil applied in November and December is preferable to plain oil sprays for black or citricola scales [*Saissetia oleae*, Bern., and *Coccus pseudomagnoliarum*, Kuw.] or *P. citri* on lemons. In districts where the scale is normally light in the tops of the trees, towers are unnecessary, and spraying entirely from the ground reduces the danger of scorching.

Arant (F. S.). **Biology and Control of the Southern Corn Rootworm.**—*Bull. Alabama Agric. Expt. Sta.*, no. 230, 46 pp., 14 figs., 69 refs. Auburn, Ala., November 1929. [Recd. 1930.]

This bulletin gives the results of three years' studies on the biology and control of *Diabrotica duodecimpunctata*, F. (southern corn rootworm) in Alabama. Much of the information is similar to that recorded from Arkansas [*R.A.E.*, A, xvii, 529]. There are three complete generations and a partial fourth in Alabama, and oviposition is practically continuous throughout the spring and summer to the middle of October. The temperature and rate of development are closely correlated ; a dry environment is fatal to the immature stages and a cold environment (10° F. or below) causes a high mortality of adults. The Tachinid parasite, *Celatoria diabroticae*, Shim., destroys considerable numbers of adults in late winter and early spring but is of little importance during the hot summer months. The most serious injury to maize is done by half-grown or mature larvae attacking the seedlings, the larvae generally being older than the maize attacked. Experiments, which are described, indicate that in fields where a winter leguminous crop is grown prior to maize, the soil should not be turned before 1st April of a normal year, and it is unsafe to plant maize for three weeks afterwards. The land should be thoroughly disked or harrowed after turning in order to destroy the food supply of the larvae. Maize grown on damp lowlands or any other susceptible area where a leguminous crop is not grown should be planted about 1st May in a normal year, the soil being turned 3–5 weeks before planting and kept free from food-plants by light cultivation. Crop rotation is not an effective measure of control.

Dunham (W. E.). **Some Parasites of the Indian Meal Moth.**—*Amer. Bee J.*, lxix, no. 8, p. 396, 4 figs. Chicago, Ill., 1929. (Abstract in *Expt. Sta. Rec.*, lxiii, no. 4, p. 359. Washington, D.C., September 1930.)

Notes are given on *Microbracon hebetor*, Say, and *Nemeritis canescens*, Grav., which are parasites of the Indian meal moth [*Plodia interpunctella*, Hb.] in Ohio. The former is said to have become sufficiently abundant during the last part of the winter months to cause a rapid reduction in the numbers of meal moths breeding in stored extracting combs.

Cagle (L.). **Life History of the Oriental Fruit Moth in Virginia.**—*Bull. Virginia Agric. Expt. Sta.*, no. 270, 48 pp., 13 figs. Blacksburg, Va., May 1930.

A detailed account is given of studies on the life-history of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental fruit moth) carried out in

Virginia from 1924 to 1929 in continuation of studies made in 1919 and 1920 [*cf. R.A.E.*, A, x, 560]. The greater part of the work was done in insectaries in which field conditions were approximated, but infested twigs were counted on a few trees in the orchard at regular intervals in order to compare development in the insectary with that under natural conditions. Four generations were reared in each year, and in 1925 the fourth generation reached the adult stage in autumn and oviposited ; it seems likely that a small fifth brood is of normal occurrence in the warmer parts of the State. The blooming period of peaches and the picking dates of the principal varieties are correlated with the development of the insect in each year. The influence of temperature on the duration of the various stages is discussed in detail ; as regards the overwintering generation pupation began when the mean temperature was 50° F. or slightly below for a few days, few moths emerged when the mean temperature was below 50°, and oviposition by these moths practically ceased when the mean temperature dropped as low as 55°. The first overwintering larvae left the fruit in July and the last transforming larvae in late September. Some of the larvae that entered apples in the late autumn remained in the fruit until the following spring, and others left it at intervals throughout the winter. Thus in the insectary the larvae passed the winter both as mature larvae in cocoons and as immature larvae in apples.

Larvae that had spun up in bunches of grass and apples containing almost mature larvae were buried at varying depths up to 10 and 12 ins. respectively, but in every case larvae were recovered at the surface within a few days.

Twig infestation was heavy during the first and second generations, but with the hardening of the twigs during the third generation there was a decline in twig infestation and a rapid increase in infestation of the fruit. This generally acts as a natural control in the case of early varieties of peach, but an abundance of tender twigs in the early season may serve as a means of building up a heavy infestation to be liberated upon late varieties when the twigs harden just previous to the ripening of the fruit. Few overwintering larvae developed in peaches of an early variety that were harvested before 9th August, but the fruit of another variety, which was not picked until the first week in September, supplied a large overwintering population.

Studies on apples as a source of overwintering larvae were carried out in the laboratory and with bait pails and bands in orchards. The results indicate that during mid-summer the moths are attracted to peaches in much larger numbers than to apples, but that in the autumn there may be a migration of moths to apple orchards. Apples in peach orchards that contain no late varieties constitute an important source of overwintering larvae.

REX (E. G.). **Facts pertaining to the Japanese Beetle.**—*Circ. New Jersey Dept. Agric.*, no. 180, 31 pp., 10 figs. Trenton, N.J., June 1930.

A popular account is given of the history, distribution, bionomics and control of *Popillia japonica*, Newm. (Japanese beetle) in the United States, with recommendations for spraying.

Stoner (D.). **Spined Soldier-bug reared on Celery Leaf-tyer.**—*Florida Ent.*, xiv, no. 2, pp. 21–22. Gainesville, Fla., June 1930.

In the course of experiments conducted with possible predators of the Pyralid, *Phlyctaenia rubigalis*, Gn. (celery leaf-tyer) in Florida, a female of *Podisus maculiventris*, Say, taken on a celery plant in an old seed bed in December 1928, fed in the insectary on 3 larvae, a pupa and 2 adults of *P. rubigalis*, and a larva of *Psara* (*Pachyzancla*) *bipunctalis*, F. ; it died after being in captivity 27 days, having laid a mass of 22 eggs on the previous day. These eggs hatched within 11 days, the nymphs showing a tendency to mass together and making no attempt to feed on the larvae of *Phlyctaenia* until 15 days after hatching. Some of them appeared to feed on the juices of celery sprigs introduced into the cage as food for the caterpillars, and they showed distinct cannibalistic tendencies. Larvae and adults of *P. rubigalis* were readily attacked by the more mature nymphs, and in one instance a pupa was sucked dry by them. On 22nd February only 2 of the nymphs remained alive. These transformed into adults on the 26th and 28th, having completed their nymphal development in 33 and 35 days respectively.

The observations indicate that this Pentatomid may breed throughout the year in Central Florida, the mean temperature out of doors during the incubation period being 65° F.

Cook (W. C.). **Field Studies of the Pale Western Cutworm** (*Porosagrotis orthogonia* **Morr.**).—*Bull. Montana Agric. Expt. Sta.*, no. 225, 79 pp., 1 pl., 13 figs., 23 refs. Bozeman, Mta., February 1930.

Much of this information on *Porosagrotis orthogonia*, Morr., has already been noticed [*R.A.E.*, A, x, 111 ; xiv, 124, 478, etc.]. The eggs are chiefly laid in fresh stubble and normally overwinter, though at a room temperature of 20° C. [68° F.] they became fully developed in about three weeks and hatched when water was applied. The larvae feed in the soil unless forced to the surface by rain, the depth at which they occur being regulated by the soil moisture. When moving, they follow the line of least resistance. It seems probable that when food is not available the larvae feed on one another, and in cases of heavy infestation, few mature larvae may be produced. The prepupal period varies in length according to the locality and season, and the pupal period lasts about 4–5 weeks. The adults emerge in late August and early September and feed for 4 or 5 days on the nectar of goldenrod (*Solidago*), rabbit brush (*Chrysothamnus*) and occasionally other plants before ovipositing. Probably 250–300 eggs are laid, the number being influenced by temperature conditions. Few eggs are deposited after 10 p.m., or when the temperature is below 12° C. [53·6° F.], and if food is not available smaller numbers are laid. A list is given of the natural enemies of *P. orthogonia*, but they do not appear to be of much importance.

If the rainfall in Montana during May, June and July is less than 4 ins., there will be an increase in the number of cutworms in the following year, whereas with a rainfall of more than 5 ins., there will be a decrease. The method of forecasting outbreaks and the climatic relations of the moth have already been noticed [*R.A.E.*, A, xi, 363 ; xiv, 124 ; xvii, 229, etc.].

Soil packing tends to force the larvae to the surface, where they may be controlled by baits. The use of a press drill is recommended in sowing wheat ; with this drill the soil is pressed firmly over the seed by a wheel that follows the drill hoe, causing the lines of least resistance to come between the drill rows. Irrigation will control the larvae and should be applied as early as possible. Although the cost of light-traps is considerable, experiments, which are discussed in detail, indicate that they might be used with advantage provided that they were operated where the moths were feeding. Fallow land that is ploughed in May and not cultivated during August is not attractive to the moths for egg-laying, and the eggs might be concentrated by the use of cultivated strips as traps, these being subsequently ploughed in. The practice of letting fields lie fallow during the summer without being ploughed, and sowing in the following spring on the top of the old stubble, is not recommended, as it provides conditions very favourable for the development of *P. orthogonia*. Land under continuous cultivation should be ploughed as early as possible in the spring. Wheat that is sown in disked ground is particularly susceptible to serious damage. All small grains, except rye, are liable to heavy infestation, but owing to the unattractive condition of the soil during moth flight, maize, potatoes and winter rye are not likely to be severely attacked.

PARKER (J. R.). **Some Effects of Temperature and Moisture upon** *Melanoplus mexicanus mexicanus* **Saussure and** *Camnula pellucida* **Scudder (Orthoptera).**—*Bull. Montana Agric. Expt. Sta.*, no. 223, 132 pp., 25 figs., 43 tables, 20 refs. Bozeman, Mta., January 1930. [Abridged as :] **Some Effects of Temperature and Moisture upon the Activities of Grasshoppers and their Relation to Grasshopper Abundance and Control.**—*4th Int. Cong. Ent. Ithaca, N. Y. 1928*, ii (Trans.), pp. 322-332, 6 refs. Tring, England, 1929.

This paper presents the results of extensive field and laboratory studies on the influence of temperature and humidity on the biology of *Melanoplus mexicanus*, Sauss. (*atlanis*, Riley) and *Camnula pellucida*, Scudd., which are the two most destructive grasshoppers in the northern United States and southern Canada. All the experiments are described in detail, and numerous figures and numerical and graphical data are included.

The development of the eggs of *M. mexicanus* is retarded when they are kept at a high temperature immediately after they are laid, and accelerated if they are first exposed for a certain period to cold. Owing to this peculiarity, the eggs laid during the summer and the autumn all hatch in the following spring. In Montana such general hatchings occur during the first warm period, when the maximum air temperature for 3–5 successive days is not below 24° C. [75·2° F.]. Data on high and low lethal temperatures for eggs of *M. mexicanus* and *C. pellucida* are included.

Nymphs reared at alternating high and low temperatures develop more rapidly than those kept under constant conditions. The daily activities of the grasshoppers are controlled to a large extent by heat ; detailed data are presented showing the air and soil surface temperatures at which various activities of the adults and nymphs take place. Heat has a marked effect on the amount of food consumed by *M. mexicanus*, feeding being at a maximum at an air temperature between

21·1 and 26·7° C. [70–80° F.] and decreasing rapidly above and below these points. It is also probably an important factor in grasshopper abundance, for maximum egg-production by *M. mexicanus* and *C. pellucida* occurs at 27–37° C. [80·6–98·6° F.] and 32–37° C. [89·6–98·6° F.] respectively.

A higher percentage of eggs of *C. pellucida* hatches in moderately damp soil than under very wet or very dry soil conditions. Experiments with eggs of *M. mexicanus* indicate a definite optimum zone with regard to temperature and relative humidity. At 22° C. [71·6° F.] the highest percentage of eggs hatches at 80 per cent. humidity, and at 27, 32 and 37° C. the optimum is 90 per cent. The higher the temperature, the narrower becomes the range of relative humidity at which hatching takes place.

Moisture affects the grasshoppers indirectly by making conditions favourable for fungous and bacterial diseases, and through their food, which, when it has a low moisture content, tends to produce larger and longer winged individuals. The possibility that *M. spretus*, Walsh (Rocky Mountain locust) is merely a dry weather migratory phase of *M. mexicanus* is suggested.

Entomology.—*41st Ann. Rep. Texas Agric. Expt. Sta. 1928*, pp. 42–49 ; *42nd, 1929*, pp. 41–47, 146–147. College Station, Tex. [1929 & 1930.] [Recd. 1930.]

Work on various entomological projects during 1928 and 1929 is briefly reviewed. Experiments on the relative number of boll weevils [*Anthonomus grandis*, Boh.] killed by the calcium arsenate adhering to different parts of dusted cotton plants showed that 2·2 per cent. were killed on the stems, 13·2 on the squares and bolls, and 84·6 on the leaves. In 1929, injury by the cotton flea-hopper [*Psallus seriatus*, Reut.] in southern and eastern Texas was more serious than at any time since 1926. Ovipositing females were probably attracted by the succulent growth on the plants induced by abnormal conditions of moisture. The number of individuals hatching from 100 *Croton* plants in April, when a large amount of cotton begins to come up, was greater than at any time since 1926, a fact confirming the theory that accurate prediction of injury to cotton may be made from information regarding the hatching or emergence of the insects [*cf. R.A.E.*, A, xviii, 64]. Dusting with sulphur proved effective. One variety of cotton, although abundantly infested, appeared to be immune from injury.

Four Tenebrionids were found attacking melons during May, the most abundant being *Blapstinus pulverulentus*, Mann., and *B. fortis*, Lec. Poison bait gave a high percentage mortality, molasses and vanilla being the best attractants tested.

California red scale [*Chrysomphalus aurantii*, Mask.] is a major pest of *Citrus* in the Lower Rio Grande Valley and is rapidly becoming more prevalent throughout the fruit-growing section. From the standpoint of scale mortality, winter fumigation with calcium cyanide dust is satisfactory, but reinfestation occurs in the latter part of July and August, causing much damage to fruit before harvest. Oils of low volatility appear to be somewhat more effective than lighter oils. Experiments show that oil sprays applied in May and July are more effective than those applied at other times. *Prospaltella aurantii*, How.,

was reared from the yellow scale [*Chrysomphalus aurantii citrinus*, Coq.] and *Aphelinus chrysomphali*, Mercet, from *C. aurantii*.

Rust mites [*Phyllocoptes oleivorus*, Ashm.] on *Citrus* can be effectively controlled by sulphur in its various forms. A spray of lime-sulphur in April and two sprays of oil emulsion, one in May and one in July, gave commercial control of both mites and Coccids on grapefruit.

Bordeaux spray with nicotine or with oil emulsion (1 per cent.) gave a more satisfactory control of bean leafhoppers [*Empoasca fabae*, Harr.] on snap beans than copper-lime dust, sulphur dust or Bordeaux alone. Oil emulsions made from highly refined oils of low volatility were more effective against *Aphis pseudobrassicae*, Davis (turnip aphis) than repeated applications of nicotine dust.

Clark (J. E.), Margary (I. D.), Marshall (R.) & Cave (C. J. P.). **Report on the Phenological Observations in the British Isles from December, 1928, to November, 1929. No. 39.**—*Quart. J. R. Met. Soc.*, lvi, no. 235, pp. 207–270, 6 figs. London, 1930. Price 3*s*.

Tables are given showing the dates of the first appearances of a few insects in various localities in the British Isles during 1929, the mean dates of their first appearance, and the differences from the average for the 35 years 1891–1925.

Brade-Birks (S. G.). **Notes on Myriapoda xxxiii: the Economic Status of Diplopoda and Chilopoda and their Allies, especially of Forms occurring in the British Isles, particularly those of Importance in Agriculture and Horticulture.**—*J. S.-E. Agric. Coll.*, no. 27, pp. 103–146, 25 figs. Wye, Kent, 1930.

The author discusses at length the economic status of Diplopoda and Chilopoda and their allies in Britain, and comes to the general conclusion that millepedes in field and garden are usually injurious, and centipedes, with the possible exception of *Geophilomorpha*, beneficial. A great deal depends, however, on the association of individual myriapod forms and plants of economic importance; for example, *Blaniulus guttulatus*, Bosc, is often associated with crops, and does considerable damage, but *Proteroiulus fuscus*, Am Stein, belonging to the same family and anatomically very similar, lives largely between the bark and trunk of old trees and causes practically no injury.

Austin (M. D.). **Field Experiments on the Control of the Apple Capsid (*Plesiocoris rugicollis* Fall.) and the Common Green Capsid (*Lygus pabulinus* Linn.) during 1929.**—*J. S.-E. Agric. Coll.*, no. 27, pp. 147–179, 3 figs., 10 refs. Wye, Kent, 1930.

A detailed account is given of field trials carried out in 1929 with various dusts and sprays against the Capsids, *Plesiocoris rugicollis*, Fall., on apples and *Lygus pabulinus*, L., on currants at various centres in England.

From the results obtained, it appears that the control of *P. rugicollis* is possible if the work is systematically carried out, a combination of methods being most successful. Of the tar-distillates, the Long Ashton wash [*R.A.E.*, A, xvii, 673] was the most effective, though one

commercial product gave consistently good results and a second showed promise. The use of a late application of a tar-distillate at a weaker strength (5 per cent.) does not appear to be justified. It is recommended that all tar-distillate washes should be followed by the application of a contact insecticide in the spring. The use of nicotine dusts and a nicotine spray did not meet with so much success as was anticipated, and the results indicate that more than two applications are necessary to ensure commercial control. Grease-banding should be carried out in conjunction with contact insecticides wherever possible, especially before the last contact spray or dust is applied, in view of the fact that many Capsids are jarred off or leave the tree during control operations. Where banding is not possible, as in the case of small trees, etc., the soil beneath the trees should be subsequently treated in the same manner as the trees themselves. The treatment of soil beneath banded trees would appear unnecessary, as the majority of the fallen Capsids will be caught on the bands or picked off the trunks of the trees by birds, which show a decided liking for the immature bugs. If, however, the Capsids are nearing maturity, they may become adult and lay their eggs in the lower part of the trunk or fly to the branches without coming into contact with the bands.

The older tar-distillates as commonly used, even at 10 per cent. strength, are useless for the control of *L. pabulinus*. Nicotine dusts and a nicotine and soft soap spray proved to be of value, but to be effective, treatment should be carried out at least twice, and sometimes three times. The dusting or spraying of soil beneath infested bushes is also recommended. Immature Capsids did not appear to fall off or leave the bushes so readily when sprayed as they did when dusted. The earlier stages of *L. pabulinus* are more susceptible to nicotine dusts than the later ones, so that early dusting is essential. Most of the adults of the first generation lay their eggs on various herbaceous plants [*cf. R.A.E.*, A, xvi, 619], and the destruction of weeds by burning or digging in is advocated as soon as they have finished ovipositing.

The more successful results obtained with nicotine against *L. pabulinus* on currants compared with their failure against *P. rugicollis* on apples is probably due to the fact that such bushes are more easy to treat thoroughly than larger trees.

STANILAND (L. N.), TUTIN (F.) & WALTON (C. L.). **The Control of Capsid Bugs on Black Currants.**—*J. Minist. Agric.*, xxxvii, no. 5, pp. 475–480, 2 diagrs., 3 refs. London, August 1930.

Capsids, chiefly *Lygus pabulinus*, L., and *Plesiocoris rugicollis*, Fall., have been causing increasingly serious injury to black currants in England [*cf. R.A.E.*, A, xvi, 426, 619], and many plantations are now practically ruined. The improved Long Ashton tar-distillate wash at 10 per cent. strength controlled them to a certain extent [xvii, 674], and satisfactory results were obtained with certain winter washes made from petroleum products, but such washes failed to control Aphids and *Psylla* [*mali*, Schmidb., on apple] [xviii, 497]. As the last-named pests may readily be controlled by a comparatively dilute concentration of tar-distillate, a mixture containing equal parts of these two liquids was prepared, with a view to obtaining a wash of wide utility. The neutral tar oil was obtained from horizontal retort tar during distillation between 280 and 360° C. ; it contained only a trace of "tar acids"

and had been deprived of excess anthracene by cooling. The heavy paraffin used had the following characteristics: specific gravity at 15° C., 0·865; flash point (closed), 275° F., (open), 305° F.; viscosity, Redwood 1 at 70° F., 130 secs.; iodine value (Wijs.), 1·1 per cent.; and sulphur (calculated as such), 0·2 per cent. The greater part of the heavy paraffin is less volatile than the high boiling neutral tar oil employed, a fact that would prolong the period during which a film of it would persist on the twigs and insect eggs [xviii, 497]. A mixture of 85 parts by volume of the mixed oils with 15 parts by volume of Agral WB was emulsified with 3 oz. caustic soda to every gallon of the concentrate; the resulting emulsion was superior to that yielded by the plain tar oil wash.

Field trials were carried out with this wash, using concentrations of 10 and 12 per cent., the sprays being applied on 5th and 6th February 1930 to six varieties of black currant. Practically complete control of Capsids was obtained. Results with the "high-neutral" tar oil wash, which was used for comparison, were similar to those of 1928–29 [xvii, 674]. No evidence of spray damage could be detected.

Oudemans (A. C.). **Acarologische Aanteekeningen. cii, ciii.** [Acarological Notes, cii, ciii.]—*Ent. Ber.*, viii, nos. 172, 173, pp. 69–74, 97–101. Amsterdam, 1st March, 1st May 1930.

The mites described include *Typhlodromus cucumeris*, sp. n., and *T. vitis*, sp. n., from melons and vines, respectively, in France, and *T. heveae*, sp. n., and *T. hevearum*, sp. n., from *Hevea* in Sumatra.

Escherich (K.). **Das Vorkommen forstschädlicher Insekten in Bayern. II. Bericht: Das Jahr 1928.** [The Occurrence in Bavaria of Insects injurious to Forests. Second Report, 1928.]—*Forstwiss. Zbl.*, 1930, no. 10, pp. 457–478, 8 figs. Berlin, 1930.

Notes are given on the incidence of many of the pests mentioned in the previous report [*R.A.E.*, A, xvii, 335]. *Hylotrupes bajulus*, L., which is attracting increasing notice, should be combated in buildings by fumigation with hydrocyanic acid gas. For telegraph poles, a trial is suggested of impregnation with an arsenical liquid in a vacuum. *Hylobius abietis*, L., proved very injurious in various districts. Arsenical dust appears to be more useful in protecting the trees against attack than in killing the weevils. *Hylophila prasinana*, L., attacked beech, defoliating it in some cases, but such outbreaks are rare. *Panolis flammea*, Schiff., and *Lymantria monacha*, L., appear to be increasing. *Prociphilus bumeliae*, Schr. (*Pemphigus poschingeri*, Holz.) attacked the roots of silver firs [*Abies*]. In one locality about 50 per cent. of 15,000 trees, 4–5 years old, were infested from ash about 1,000 yards away.

Escherich (K.). **Das neue Gesicht der Forstentomologie.** [The new Aspect of Forest Entomology.]—*Forstwiss. Zbl.*, 1930, no. 12, pp. 525–546, 9 figs., 16 refs. Berlin, 1930.

A study of the factors concerned in the occurrence of outbreaks is now realised to be essential in any serious investigation on forest

entomology. The tendency is to attach less significance to parasites than to abiotic factors, particularly climate, the importance of which has been clearly shown by Bodenheimer [*R.A.E.*, A, xvii, 489]. Based chiefly on Bodenheimer's work, a review is given of the results achieved in recent years in the correlation of climate with outbreaks.

Rademacher (B.). **Vergleichende Untersuchungen über Stäube- und Köderverfahren bei der Bekämpfung der Rübenaaskäfer.** [Comparative Investigation on Insecticide Dust and Bait Methods against Beet Silphid Beetles.]—*Arb. biol. Reichsanst.*, xviii, no. 1, pp. 101–115, 2 figs., 20 refs. Berlin, May 1930.

The various attempts hitherto made to control Silphids attacking beet by means of poison-baits are briefly reviewed. In laboratory and field experiments a proprietary poison-bait containing fluorine and bran proved of some value against *Blitophaga opaca*, L.

Schwarz (L.) & Deckert (W.). **Zur hygienischen Beurteilung von T-Gas (Aethylenoxyd) als Schädlingsbekämpfungsmittel.** [The value of T-Gas (Ethylene Oxide) as a Fumigant against Pests.]—*Z. Desinfekt.*, xxii, no. 7, pp. 532–552, 10 refs. Dresden, July 1930.

A brief survey is given of the literature on ethylene oxide, and a method for determining the presence of this gas is described. Tests showed that various cockroaches, *Tenebrio molitor*, L. (larvae and adults), *Calandra granaria*, L., *Cimex lectularius*, L., and rats are killed if exposed to it for 24 hours when used at the rate of 32 oz. to 1,000 cu. ft. Experiments in America have shown that the flavour of ham, chocolate, and cacao is impaired by fumigation and the germination of grain is decreased, but flour has not been found to be affected.

Werth (E.) & Klemm (M.). **Zur wirtschaftlichen Bedeutung des Apfelblütenstechers (*Anthonomus pomorum* L.).** [On the economic Importance of the Apple Blossom Weevil.]—*NachrBl. deuts. PflSchDienst*, x, no. 7, pp. 55–56, 3 figs. Berlin, July 1930.

The authors point out that Kamuishnuiĭ's conclusions regarding blossoms infested by *Anthonomus pomorum*, L. [*R.A.E.*, A, xvii, 6] were based on observations on pears. Their own investigations in Berlin showed that in these trees the individual flowers develop progressively from the base and periphery towards the centre of the inflorescence, whereas the contrary occurs in apple, so that the results obtained are not necessarily applicable to the latter, which is the chief plant attacked by this weevil. In pear the infestation of the various flowers in an inflorescence is fairly uniform, while the natural loss is most severe in the upper groups. In apple both infestation and natural loss are less in the central flowers than in the outer ones. Contrary to what occurs in pear, the central flowers in apple thus yield more fruits that remain on the tree than the outer ones. Even in a hypothetical, extremely severe, infestation of apple by *A. pomorum*, the damage done is only equivalent to the natural loss, and no economic injury results.

LINDINGER (L.) & others. **Bericht über die Tätigkeit der Abteilung für Pflanzenschutz.** [Report on the Activities of the Department of Plant Protection, Hamburg, January–December 1929.]—*Jber. Inst. angew. Bot. Hamburg, 1929*, pp. 88–141. Hamburg, 1930.

This report for 1929 comprises information of the same character as preceding issues [*R.A.E.*, A, xvii, 699]. Numerous records by Dr. Lindinger of Coccids and their food-plants collected over many years from various parts of the world are included.

LOSCHNIGG (F.). **Die Zwetschenkultur und deren Feinde in Jugoslavien.** [Plum Growing and its Enemies in Jugoslavia.]—*Nachr. SchädBekämpf.*, v, no. 2, pp. 87–96, 8 figs. Leverkusen a. Rh., July 1930.

It is estimated that the number of plum trees in Jugoslavia has fallen from 56 million in 1920 to some 40 million, partly owing to infestation by *Lecanium corni*, Bch., which was observed in Bosnia in 1919 and has now spread all over the country. The first attempts to control it were made in 1926 [*R.A.E.*, A, xviii, 432].

BODENHEIMER (F. S.) & NAIM (A.). **Studien zur Lebensgeschichte von *Carpocapsa pomonella* L. (Lep. Tortr.) in Palästina.** [Studies on the Life-history of *Cydia pomonella* in Palestine.]—*Anz. Schädlingsk.*, vi, no. 7, pp. 73–79, 4 figs., 4 refs. Berlin, 15th July 1930.

Studies on *Cydia* (*Carpocapsa*) *pomonella*, L., in Palestine showed great variation in its numbers and seasonal distribution. There are two generations a year, and on the coast a partial third; a few late individuals of the first generation, however, may hibernate. The adults from the overwintered larvae begin to appear in mid-April, the majority emerging in May and June, and those of the first generation occur from about mid-July to the end of August. At the end of July most of the apples or pears are infested in orchards where the moths occur. As the native varieties of apple begin to set fruit earlier than the European ones, and late varieties of pear, and particularly quince, mature in October, blossoms and fruits in all stages are present from spring to autumn, and this provides optimum conditions for the moth and makes spraying with arsenicals a difficult matter. Differences in susceptibility to infestation in certain varieties of apple are discussed, and it is suggested that a few varieties that would all blossom within a short period and not ripen late should be grown. The fruits should be separated by thinning, and should be harvested at the first sign of ripening and kept in cold storage until sold. The influence of temperature on *C. pomonella* is discussed, and evidence is presented to show that the hyperbolic curve [*R.A.E.*, A, xiv, 416] provides even in the complicated conditions in Palestine a reliable means of calculating the course of development.

MISRA (A. B.). **On a Collection of Lac Insects from Northern India.**—*Bull. Ent. Res.*, xxi, pt. 2, pp. 161–164. London, July 1930.

The following new species are described, with a key: *Laccifer longispina*, *L. kydia*, *L. pusana*, *L. ambigua*, *L. jhansiensis*, and *L. indica*.

Papers noticed by Title only.

Hayes (W. P.). **Morphology, Taxonomy, and Biology of** [North American] **Larval Scarabaeoidea.**—*Illinois Biol. Monog.*, xii (1929), no. 2, 119 pp. (85–203), 15 pls., 3 pp. refs. Urbana, Ill., 1930.

Twinn (C. R.). **A Summary of Insect Conditions in Canada in 1929.**—*Sci. Agric.*, x, no. 11, pp. 754–758. Ottawa, Ont., July 1930.

Caesar (L.). **Insects attacking Fruit Trees.**—*Bull. Ontario Dept. Agric.*, no. 356, 70 pp., text ill. [Toronto] 1930. [No. 250 revd., *cf. R.A.E.*, A, vi, 540.]

Cook (W. C.). **A new Species of** *Euxoa* [*mcdunnoughi*, sp. n., from Montana] **and some Notes on** *Chorizagrotis* [forms and synonymy of *C. auxiliaris*, Grote] **(Lepidoptera).**—*Canad. Ent.*, lxii, no. 7, pp. 147–150, 3 refs. Orillia, Ont., July 1930.

Knowlton (G. F.). **Notes on Utah Lachnea (Aphididae).**—*Canad. Ent.*, lxii, no. 7, pp. 152–161, 6 figs. Orillia, Ont., July 1930.

Schedl (K. E.). **Notes on the Pityophthorinae (Coleopt. Ipidae). I. Description of new Species** [of *Pityophthorus* from Canada].—*Canad. Ent.*, lxii, no. 9, pp. 195–199, 1 pl. Orillia, Ont., September 1930.

Common Names of Insects approved for general Use by American Economic Entomologists [fifth supplement, 23 names].—*J. Econ. Ent.*, xxiii, no. 3, p. 639. Geneva, N.Y., June 1930. [*Cf. R.A.E.*, A, xviii, 87, etc.]

Taylor (R. L.). **A new Host Record for the White Pine Weevil** [*Pissodes strobi*, Peck, on *Pinus montana* in Maine].—*J. Econ. Ent.*, xxiii, no. 3, p. 640. Geneva, N.Y., June 1930.

Hodgkiss (H. E.). **The Eriophyidae of New York. II. The Maple Mites.**—*Tech. Bull. New York State Agric. Expt. Sta.*, no. 163, 45 pp., 14 pls., 1 fig. Geneva, N.Y., July 1930.

Smith (M. R.). **Another imported Ant** [*Prenolepis bourbonica*, Forel, in Florida].—*Florida Ent.*, xiv, no. 2, pp. 23–24. Gainesville, Fla., June 1930.

Light (S. F.). **A practical Key to the Species of Termites found in California.**—*Mon. Bull. Dept. Agric. California*, xix, no. 6, pp. 454–455. Sacramento, Cal., June 1930.

Lobdell (G. H.). **Twelve new Mealybugs from Mississippi (Homoptera : Coccoidea).**—*Ann. Ent. Soc. Amer.*, xxiii, no. 2, pp. 209–236, 14 pls., 6 refs. Columbus, Ohio, June 1930.

Hughes-Schrader (S.). **Contributions to the Life History of the Iceryine Coccids, with special Reference to Parthenogenesis and Hermaphroditism.**—*Ann. Ent. Soc. Amer.*, xxiii, no. 2, pp. 359–380, 23 refs. Columbus, Ohio, June 1930.

Walton (W. R.) & Packard (C. M.). **The Hessian Fly** [*Mayetiola destructor*, Say] **and how Losses from it can be avoided.**—*Fmrs'. Bull. U.S. Dept. Agric.*, no. 1627, 14 pp., 14 figs. Washington, D.C., May 1930. [No. 1083 revd., *cf. R.A.E.*, A, viii, 376.]

HUSMANN (G. C.). **Testing Phylloxera-resistant Grape Stocks in the Vinifera Regions of the United States.** —*Tech. Bull. U.S. Dept. Agric.*, no. 146, 53 pp., 10 pls., 2 refs. Washington, D.C., February 1930.

ROARK (R. C.). **Review of United States Patents relating to Pest Control** [issued January-June 1930].—iii, nos. 1–6; 12, 13, 9, 16, 14, 20 pp. multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Chemistry & Soils, 1930.

SPAETH (F.). **Mitteilungen ueber die Cassidinen des National-Museum in Prag. II. (Col., Chrysomelidae)** [including *Neomphalia bondari*, sp. n., on Sweet Potato in Brazil].—*Sbornik ent. Odd. národ. Mus. Praze*, vi, pp. 29–47. Prague, 1928. [Recd. 1930.]

[BONDAR (G.).] *Ceratitis capitata.* **Praga do café no Estado da Bahia.** [*C. capitata*, a Pest of Coffee in Bahia.]—*O Campo*, i, no. 1, pp. 105–106. Rio de Janeiro, January 1930. [See *R.A.E.*, A, xiv, 239.]

WILLARD (H. F.) & BISSELL (T. L.). **Parasitism of the Mediterranean Fruit Fly** [*Ceratitis capitata*, Wied.] **in Hawaii, 1922-1924.**—*Circ. U.S. Dept. Agric.*, no. 109, corrected edn., 12 pp., 5 tables, 10 refs. Washington, D.C., March 1930. [*Cf. R.A.E.*, A, xviii, 341.]

ROEPKE (W.). **Beobachtungen an Indischen Honigbienen, insbesondere an *Apis dorsata* F.** [Observations on Dutch East Indian Honey Bees, particularly *A. dorsata*.]—*Meded. Landbouwhoogeschool*, xxxiv, no. 6, pp. 1–28, 6 pls., 4 figs., 33 refs. Wageningen, 1930. (With a Summary in Dutch.)

MALENOTTI (E.). **Ueber die Systematik von *Pseudococcus vitis* Niedl., über die biologischen Wechselbeziehungen zwischen *Simaethis nemorana* Hübn. und *Pseudococcus citri* Risso und ihre Bedeutung im Weinbau.** [On the Classification of *P. vitis*, and on the biological Relation between *Hemerophila nemorana* and *P. citri*.]—*Anz. Schädlingsk.*, vi, nos. 7–8, pp. 79–83, 91–94, 9 figs., 16 refs. Berlin, 15th July–15th August 1930. [See *R.A.E.*, A, xvii, 150.]

SAUTET (J.). ***Adelina tenebrionis* n. sp., parasite du coelome de la larve de *Tenebrio molitor* (note préliminaire).**—*Ann. Parasit. hum. comp.*, viii, no. 3–4, pp. 241–243, 2 figs. Paris, 1st July 1930.

POPOVIČ (I.). **Ergebnisse von Versuchen zur Bekämpfung der gemeinen Schildlaus (*Lecanium corni*) auf Zwetschenkulturen in Bosnien.** [Results of Experiments in combating *L. corni* on Plum Trees in Bosnia.]—*Nachr. SchädlBekämpf.*, v, no. 2, pp. 96–106, 2 figs. Leverkusen a. Rh., July 1930. [*Cf. R.A.E.*, A, xviii, 432.]

ROZSYPAL (J.). **Die braune Apfelbaumgespinstmotte (*Simaethis pariana* L.), der Schädling der Apfelbäume in Mähren im Jahre 1927 und 1928.** [*Hemerophila pariana*, Clerck, as a Pest of Apple Trees in Moravia in 1927–28.]—*Nachr. SchädlBekämpf.*, v, no. 2, pp. 106–110, 5 figs. Leverkusen a. Rh., July 1930. [*Cf. R.A.E.*, A, xvii, 131.]

MARCHAL (P.). **Tratamientos insecticidas para la destrucción del pulgón lanígero.** [A Review of Insecticide Treatments for destroying *Eriosoma lanigerum*, Hausm.]—*Bol. Agric. téc. econ.*, Sec. doctrinal, xxii, no. 258, pp. 275–282. Madrid, June 1930. [*Cf. R.A.E.*, A, xviii, 564.]

von Lengerken (H.). **Ueber die geographische Verbreitung und die Blattschnittmetthode des Ahornblattrollers** (*Deporaus tristis* **F.**) [**Coleopt.**]. [The geographical Distribution and Leaf-cutting Methods of the Maple Leaf-roller (*Rhynchites tristis*).]—*Zool. Anz.*, xc, no. 9–12, pp. 269–273, 3 figs., 1 ref. Leipzig, 15th September 1930. [*Cf. R.A.E.*, A, xvii, 607.]

Wallengren (H.). *Metarrhizium anisopliae* **och** *Pyrausta nubilalis* **Hb.** [*M. anisopliae* and *P. nubilalis*.]—*Acta Univ. Lund.*, N.S., xxv, no. 15, 20 pp., 17 figs., 8 refs. Lund, 6th November 1929. (With a Summary in German.) [*Cf. R.A.E.*, A, xviii, 151.]

Arnhart (L.). **Die Latschen-Honigtau liefernde** *Lachnus neubergi* **n. spec.** [*L. neubergi*, sp. n., producing Honey Dew on *Pinus montana* in Austria.]—*Z. angew. ent.*, xvi, no. 2, pp. 392–398, 6 figs., 4 refs. Berlin, May 1930.

Höstermann (G.) & Rülke (K.). **Heterozyklische Basen als Nikotin-Ersatzmittel und Prüfung derselben auf ihre Verwendbarkeit als Insektenbekämpfungsmittel.** [Heterocyclic Bases as Substitutes for Nicotine and their Examination for Suitability as Insecticides. (A Summary of the Literature.)]—*Z. angew. Ent.*, xvi, no. 2, pp. 408–413, 1 diagr., 30 refs. Berlin, May 1930.

Middelen tegen plantenziekten en schadelijke dieren in land- en tuinbouw. [Remedies against Plant Diseases and Pests in Agriculture and Horticulture.]—*Versl. & Meded. PlZiektenk. Dienst*, no. 43, 24 pp. Wageningen, May 1930. [2nd revd. edn., *cf. R.A.E.*, A, xiv, 100.]

Stellwaag (F.). **Eine Forschungstelle für angewandte Entomologie in der Pfalz. (Die Zoologische Station der staatlichen Lehr- und Versuchsanstalt für Wein- und Obstbau in Neustadt a. d. Hdt.)** [A Research Station for Applied Entomology in the Palatinate. The Zoological Station of the State School and Experiment Institute for Vine and Fruit Growing at Neustadt a. d. Hdt.]—4to, 10 pp., 5 pls. [Neustadt a. d. Hdt., 1930.]

Franssen (C. J. H.). **Aanteekeningen over het prepareeren van kleinere insecten.** [Notes on the Preservation of small Insects, Aphids, Coccids and Aleurodids.]—*Ent. Ber.*, viii, no. 173, pp. 87–88. Amsterdam, 1st May 1930.

Barnes (H. F.). **On some Factors governing the Emergence of Gall Midges (Cecidomyidae : Diptera).**—*Proc. Zool. Soc. Lond.*, 1930, pt. 2, pp. 381–393, 4 figs., 7 refs. London, August 1930.

Marshall (J. F.). **A new Form of Apparatus for photographing Insects.**—*Bull. Ent. Res.*, xxi, pt. 2, pp. 139–140, 2 pls. London, July 1930.

Staniland (L. N.) & Walton (C. L.). **Tar Distillate Washes as a Control for Apple Capsid Bug** [*Plesiocoris rugicollis*, Fall.] : **Field Experiments 1929.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1929*, pp. 101–114, 10 pls., 1 diagr., 5 refs. Long Ashton, Bristol [1930]. [*Cf. R.A.E.*, A, xvii, 673 ; xviii, 176.]

Walton (C. L.). **The Raspberry and Loganberry Beetle** [*Byturus tomentosus*, F.] **and its Control : Some Experiments with a Pyrethrum Emulsion Spray.**—*Rep. Agric. Hortic. Res. Sta. Bristol 1929*, pp. 115–123, 15 refs. Long Ashton, Bristol [1930]. [*Cf. R.A.E.*, A, xviii, 498.]

Hall (W. J.). **Notes on the Control of some of the more important Insect Pests of Citrus in Southern Rhodesia.**—*Rhodesia Agric. J.*, xxvii, no. 7, pp. 737–747. Also as *Bull. Min. Agric. Lds.* [*S. Rhodesia*], no. 790, 12 pp. Salisbury, July 1930.

An account is given of the more important pests of *Citrus* in Southern Rhodesia and of the measures taken for their control on certain estates. *Aphis tavaresi*, Del G., occurs during the winter in small colonies on young trees or bearing trees with some young growth. Towards the spring these colonies increase rapidly, and the infestation reaches its maximum between early July and the latter part of September. Spraying the winter colonies before the Aphids become numerous enough to give rise to an alate generation has been found to reduce considerably the ultimate degree of attack. Heavy infestation has been observed to follow seasons of heavy summer rainfall, probably owing to the increased amount of new growth available for the Aphids during the winter. The critical period as regards injury is between the swelling of the buds and the dropping of the petals, since a few Aphids on a young shoot will arrest the development of the blossom buds and ultimately cause them to fall, whereas after the petals have fallen the growth hardens and a much larger number of Aphids may be present without causing appreciable damage. After flowering, only those groves that become heavily infested are sprayed. The pest is automatically controlled by the higher temperatures at the end of September. The most satisfactory spray formula is lime-sulphur (1 : 100), with 8 oz. 40 per cent. nicotine sulphate and 8 oz. Capex spreader [to 100 gals.].

The larvae of *Heliothis* (*Chloridea*) *obsoleta*, F., feed on the young fruit, and it is estimated that one caterpillar may ruin 25 fruits. Eggs are laid, usually on the leaves, from about 25th August until the second half of September. At this time the egg stage lasts 4 days and the larval about 26. As the caterpillars are not easily seen until they are about 10 days old, when a considerable amount of the damage has already been done, hand-picking of the larvae has not been found very satisfactory, and hand-picking of the eggs is now being carried out. The use of ovicides is not economically practicable, and bait-traps for the moths have so far been unsuccessful.

The direct injury caused by *Scirtothrips aurantii*, Faure [*R.A.E.*, A, xviii, 241] is seldom sufficiently serious to render fruit unsuitable for export, but in Southern Rhodesia climatic conditions during the rainy season result in " tear-staining " developing from the original injury. This indirect injury is extremely serious. On one estate in 1928, it was estimated at the end of November, when thrips marking alone was present, that not more than 10 per cent. of the crop would be unfit for export, whereas at the end of the rainy season when tear-staining had developed, over 80 per cent. of the fruit was useless. Lime-sulphur is usually recommended against this pest, but in Southern Rhodesia the first application is made towards the end of September when Aphids are still present, and nicotine is therefore included, the formula adopted being lime-sulphur (1 : 100), with 6 oz. 40 per cent. nicotine sulphate and 6–8 oz. Capex spreader [to 100 gals.]. The first application should be made when the fruit is the size of a pea, just before the migration of the thrips from the foliage, and the second nine days later. A third spraying is necessary under certain conditions. Towards the end of November the thrips again become numerous, but the fruit is sufficiently large to be more or less immune from further injury, and the insects return to the foliage.

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In December the lowered temperatures and the humid conditions prevailing result in a second Aphid attack, but owing to climatic conditions no control measures can be undertaken unless a dry period occurs. During the rains between December and April attack by *Coccus* (*Lecanium*) *hesperidum*, L. (soft scale) and *Chrysomphalus* (*Aonidiella*) *aurantii*, Mask. (red scale) is also observed, the latter being a major pest. Owing to climatic conditions, fumigation with hydrocyanic acid gas against it can only be undertaken on a large scale when the fruit is almost fully developed, that is between the end of April and the end of June, when the rains have ended and the new growth has not yet appeared, so that even if the scale is killed there is no time for it to drop off and the fruit to recover. Treatment is made to prevent infestation in the following year. Annual fumigation against *C. aurantii* is now undertaken and has almost completely controlled *Coccus hesperidum*. The total cost of the control measures averaged 2*s*. per tree, and the value of the fruit is assessed at £2 12*s*. 6*d*. As cases have occurred in which the exportable crop has been reduced to 50 per cent. by thrips alone, 4 per cent. is not considered a high premium for insect control.

KIRKPATRICK (T. W.). **Preliminary Note on Leaf-crinkle of Cotton in the Gezira Area, Sudan.**—*Bull. Ent. Res.*, xxi, pt. 2, pp. 127–137, 5 refs. London, July 1930.

Leaf-crinkle of cotton has probably been present in the Gezira area for a number of years, although it was not noticed until the season of 1927–28. An account is given of the symptoms of the disease, which have also been observed on *Hibiscus esculentus* and *H. cannabinus*, the rate of its recent spread and its effect on the cotton plant. Experiments have shown that it can be conveyed mechanically by inoculations in various ways, but it has been established by growing plants under muslin cages and comparing them with unprotected plants that it is transmitted by insects, the most likely vectors being Aleurodids or the Jassid, *Empoasca facialis*, Jac. Experiments, however, indicated that the latter is certainly not mainly responsible for carrying leaf-crinkle, and is probably incapable of being a vector [*cf. R.A.E.*, A, xvi, 357, 376], and there is no apparent correlation between its abundance and the incidence of the disease in the field. Transmission experiments with Aleurodids indicated that they are the main, and probably the only, vectors of the disease. Several tests with the flea-beetle, *Nisotra uniformis*, Jac., all gave negative results, so that the only possible subsidiary carriers are Aphids, which are practically non-existent in the Gezira district until late in the season and could not be responsible for the main spread of the disease.

Several points requiring investigation are indicated. They include the incubation period of the disease in the Aleurodid and in the plant; the manner in which it is carried over from one season to the next; and the bionomics of the Aleurodids, particularly their habits from June to August, when there is no cotton in the Gezira district.

MOREAU (R. E.). **Locust-hoppers and Birds in East Africa.**—*Bull. Ent. Res.*, xxi, pt. 2, pp. 141–145. London, July 1930.

A list is given of the species of birds observed in the northern provinces of Tanganyika Territory during a specially severe outbreak of locusts

in 1929. Of the 63 species noticed, there were only eight in respect of which there were any grounds for supposing that they were paying any special attention to locusts. Of these, four taken together did not number more than 50 individuals, and of the other four only *Perissornis carunculatus* (wattled starling) could be numbered in hundreds. The list does not include a single species that might be expected to be a non-resident.

From the relative numbers of locust hoppers and birds preying upon them, it is clear that in this particular instance the influence of birds upon the infestation must have been negligible. This is definitely at variance with the observations made during locust outbreaks in Uganda and South Africa [*cf. R.A.E.*, A, xviii, 102, 530]. It is possible that the smallness of the numbers of birds observed was due to the area of locust prevalence being only on the fringe of an exceedingly widespread and severe infestation that began and was centred in Kenya, or alternatively that the conditions were typical of those that exist during outbreaks in Tanganyika.

WILKINSON (D. S.). **New Species and Host Records of Ichneumonidae and Braconidae.**—*Bull. Ent. Res.*, xxi, pt. 2, pp. 147–158, 4 figs. London, July 1930.

The parasites dealt with include: the Ichneumonids, *Phaenolobus alcides*, sp. n., bred from the weevil, *Alcides erythropterus*, Chev., in Tanganyika Territory, and *Melanichneumon muciallae*, sp. n., and *Nemeritis palmaris*, Wlkn. [*R.A.E.*, A, xvii, 22] from pupae and larvae, respectively, of *Tirathaba* sp. in Java; and the Braconids, *Apanteles flavipes*, Cam., from larvae of *Diatraea* sp. and eggs of *D. auricilia*, Dudg., in Malaya, *A. rufulus*, sp. n., from a lac insect in India, *A. tirathabae*, Wlkn., from *Tirathaba* sp. in Java, *Microgaster psarae*, Wlkn., from the larva of a Pyralid leaf-roller in Ceylon, *Meteorus dichomeridis*, sp. n., from larvae of *Dichomeris evidantis*, Meyr., in the Punjab, *M. tabidiae*, sp. n., from larvae of *Tabidia aculealis*, Wlk., in Ceylon, and *M. trichogrammae*, sp. n., from larvae of *Tirathaba trichogramma*, Meyr., in the Fiji Islands.

MASSEE (A. M.). **On some Species of Gall-mites (Eriophyidae) found on** *Corylus avellana*, **L.**—*Bull. Ent. Res.*, xxi, pt. 2, pp. 165–168, 1 pl. London, July 1930.

Notes are given on the habits of *Eriophyes avellanae*, Nal. (nut gall-mite), which commonly infests hazel (*Corylus avellana*) in Britain, and also occurs in America and Continental Europe. Its life-cycle is very similar to that of *E. ribis*, Nal., on black currant [*R.A.E.*, A, xvi, 231]. The mites live freely on the leaves during April, May and June, migrating from the older foliage as soon as new growth is produced to enter the newly formed buds. After 4–5 weeks the infested buds begin to swell, and by the end of August typically enlarged buds are plainly visible. The mites remain in the "big-buds" throughout the winter and migrate from them at the end of March or in April. The apical buds of shoots are nearly always attacked, and as many as 80 per cent. of the buds are sometimes infested. When buds are infested without apparent swelling, they usually dry out in the following spring. Cultivated nuts are attacked, as well as wild hazel, and the mite, which has not hitherto been considered of economic importance,

is now sufficiently numerous to cause damage to bushes by checking rhe production of new growth and attacking the female flowers.

A severe local attack was observed in Kent in November 1928, when about 70 per cent. of the buds were infested, and the damage became more evident at the end of the year, when many of the male catkins were observed to be distorted and produced little or no pollen. In February and March 1929 damaged female flowers were found on all bushes, 40 per cent. of them being destroyed in some cases. The damage caused to the flower buds is similar to that in the leaf-buds and prevents them from producing fruits. Preliminary experiments indicated that the mites may be controlled by spraying with lime-sulphur, 1 : 30, during the latter part of March or in April, when they are migrating from the infested buds.

Detailed descriptions are given of *E. avellanae*, and of *E. vermiformis*, Nal., *Phyllocoptes comatus*, Nal., and *Oxypleurites depressus*, Nal., which also occur on hazel in Britain, but are not considered of economic importance.

ROBERTS (J. I.). **The Tobacco Capsid** (*Engytatus volucer*, **Kirk.**) **in Rhodesia.**—*Bull. Ent. Res.*, xxi, pt. 2, pp. 169–183, 1 pl., 2 figs., 28 refs. London, July 1930.

A study on the possible relation of insects to tobacco mosaic in Rhodesia was begun at the start of the season of 1928–29. The Rhynchota found on tobacco during the growing season were the Coreid, *Acanthocoris fasciculatus*, F., which is a general feeder on solanaceous plants, an Aleurodid, which has never been observed breeding on tobacco, the cotton Jassid, *Empoasca facialis*, Jac., which occasionally occurs on the upper surface of the leaves, and the Capsid, *Engytatus volucer*, Kirk., which was the only sucking insect found actually living and breeding on the plants. The adult and nymphal instars of *E. volucer* are described, and its habits on tobacco, on which it occurs throughout the growing season, are discussed. In experiments, none of the four insects transmitted tobacco mosaic, but the feeding or an injection of the macerated contents of the thorax of *E. volucer* caused a rolling and puckering of the leaf surface.

Two forms of injury arise from the feeding of this Capsid, *viz.*, punctures caused in the selection of the feeding site, which give a shot-hole appearance in the leaves, and a contraction of the leaf surface owing to the action of the escaping saliva, which spreads into the neighbouring cells from the seat of the original puncture. Although the crinkle in the leaf is the most important injury from the grower's point of view, the veins and stems suffer equally and the plant is stunted. The injury is aggravated in weakened plants grown in unfavourable soil or under other conditions that adversely affect the root system. Early planting in December is recommended, or even earlier if the rains are suitable, so that the plants will be well established before the height of the infestation in April.

BÖRNER (C.). **Beiträge zu einem neuen System der Blattläuse.** [Contribution to a new Classification of Aphids.]—*Arch. klass. phylog. Ent.*, i, no. 2, pp. 115–194. Vienna, 15th March 1930.

This revision of the genera of Aphids includes an alphabetical list showing the genotypes.

SCHEIDTER (F.). **Die Läuse unserer Nadelhölzer.** [The Aphids and Coccids of our Conifers.]—Demy 8vo, viii+119 pp., 68 figs., 116 refs. Neudamm, J. Neumann, 1930. Price *M.* 8.

In this manual for German foresters, the Aphids and Coccids are divided according to the trees attacked, notes being given on their bionomics and control. A key to the species, arranged according to the parts of the plants infested, is included.

FLACHS (K.). **Wanzenschäden an Kulturpflanzen im Sommer 1929.** [Injury to Cultivated Plants by Bugs in the Summer of 1929.]—*Prakt. Bl. Pflanzenb.*, viii, no. 5, pp. 99–102. Freising, August 1930.

Plant-bugs were very numerous in some districts of Bavaria in 1929. The Capsid, *Miris dolabratus*, L., attacked the leaves and ears of rye and wheat, the greatest injury occurring in May, June and July. The females oviposit in summer in the lowest stem-joints of various grasses, and burning the grass on the edges of fields to destroy the eggs may prevent an outbreak in the following year. The Pentatomid, *Eurydema oleraceum*, L., which is only abundant in certain years, destroyed radish crops in some places, afterwards migrating to gherkins, beans, etc. Other food-plants include cabbage, rape, lettuce and asparagus. The eggs are laid on the lower surface of the leaves in May and June and hatch in about a month. The new generation reaches the adult stage in late summer, when most of the injury is caused. The bugs occasionally attack the adults and pupae of the Coccinellids, *Adalia bipunctata*, L., and *Coccinella decempunctata*, L. The measures recommended include shaking the larvae on to boards smeared with an adhesive and spraying the plants and the ground beneath them with a contact insecticide. After harvesting, the soil should be treated with a 2½ per cent. solution of commercial formalin to kill the bugs hibernating in the ground. Against *Lygus kalmi*, L., injuring the heart-leaves of celery, the leaves should be dusted with a mixture of 2 parts quick-lime and 1 part sulphur, or a spray of nicotine-soap may be used.

FRANSSEN (C. J. H.). **De bestrijding van de wasmot** (*Galleria mellonella* **L.**) **op Java in kasten van** *Apis indica* **F.** [Control of the Wax Moth in Java in Hives of *A. indica.*]—*Algem. LandbWkBl. Ned.-Ind.*, xv, nos. 2–3, pp. 40–42, 68–70. Bandoeng, 12th–19th July 1930.

Brief notes are given on the morphology and bionomics of *Galleria mellonella*, L. (wax moth) as observed in Java. *Apis indica*, F.; can usually only protect its hives against infestation if they are constructed on certain definite principles, which are detailed. Of the two types of hive in use in Java, one complies with these requirements, and infestation does not occur if the colony is a strong one and able to guard the entrance. Any incipient infestation should be dealt with at once by fumigation.

Krishnamurti (B.). **Aphididae of Mysore.**—*J. Bombay Nat. Hist. Soc.*, xxxiv, no. 2, pp. 411–419, 13 figs. Bombay, July 1930.

In this second paper [*cf. R.A.E.*, A, xvii, 264], the new species described include *Macrosiphum eleusinae* on *Eleusine coracana* (ragi), *Hyalopterus carii* on *Carum copticum* (caraway), and *Oregma mysorensis* on bamboo. *Tetraneura hirsuta*, Baker, is recorded from the roots of sugar-cane.

Misra (M. P.), Negi (P. S.) & Gupta (S. N.). **The Noctuid Moth** (*Eublemma amabilis*, **Moore**) **; a Predator of the Lac Insect, and its Control.**—*J. Bombay Nat. Hist. Soc.*, xxxiv, no. 2, pp. 431–446, 5 pls., 7 tables, 16 refs. Bombay, July 1930.

A detailed account is given of the morphology of all stages and the bionomics of the Noctuid, *Eublemma amabilis*, Moore, which is predacious on lac insects in India, where it is widely distributed and is responsible for 30 per cent. of all the damage to lac by insects. The periods of emergence of each of the six generations a year and their relation to the various crops of lac are described. The egg stage lasts from 1 to 10 days, the larval from 16 to 128 and the pupal from 3 to 20, all these stages varying according to the season. From November to February, the larvae are largely inactive. Eggs are deposited singly or in batches between the developing larvae of the lac insect and in crevices in the lac incrustation. The minimum and maximum length of the egg stage and duration of hatching for 11 months are shown in a table. The larvae bite small holes into the incrustation and feed on the male and female lac larvae within the resinous tests. A single larva devours 40–45 mature cells, and not only destroys the insects, but also eats the lac incrustation. Pupation occurs in the tunnel made by the larva.

The larvae of *Eublemma* are attacked by *Microbracon* (*Bracon*) *tachardiae*, Cam., an unidentified Braconid, *Brachymeria* (*Chalcis*) *tachardiae*, Cam., *Elasmus claripennis*, Cam., *Camponotus compressus*, F., *Solenopsis geminata*, F., and *Ephestia* sp., which also destroys the pupae. Remedial measures include keeping the portion of the crop used as brood lac for infecting the plants under water for 6–10 days immediately after all lac insect larvae have emerged from it, the rest of the crop being similarly treated after it has been reaped. Selected and, as far as possible, predator- and parasite-free brood should be used for every crop, and self-inoculation should be avoided. As an alternative to the water treatment, fumigation with carbon bisulphide at the rate of 1 oz. to 10 cu. ft. of space may be employed.

Kawada (A.). **A List of Cochlidionid** [Limacodid] **Moths in Japan, with Descriptions of two new Genera and six new Species.**—*J. Imp. Agric. Expt. Sta.*, i, no. 3, pp. 231–262, 1 pl., 21 figs., 3 pp. refs. Tokyo, March 1930.

This is a revision of the Limacodid moths of Japan, many of which cause considerable damage to farm and fruit plants in the tropics and subtropics. In the Japanese Empire the moths are extensively distributed from Hokkaido to Formosa. *Cnidocampa flavescens*, Wlk., is recorded for the first time from Formosa.

GRAHAM (S. A.). **The Larch Sawfly as an Indicator of Mouse Abundance.**—*J. Mammalogy*, x, no. 3, pp. 189–196. Baltimore, Md., August 1929. [Recd. 1930.]

In the study of factors operating in the control of the larch sawfly [*Lygaeonematus erichsoni*, Htg.] in Michigan and Minnesota, mice were found to be among the most important, destroying an average of 60 per cent. of the larvae in cocoons [*cf. R.A.E.*, A, xvi, 511 ; xviii, 308]. Those opened by mice are easily distinguished by the marks of their incisors. Only the soft internal parts of the larvae are eaten, the skin and hard parts being left. This type of food would not, therefore, be evident in examination of the stomach contents of mice.

McDONNELL (C. C.), ABBOTT (W. S.), DAVIDSON (W. M.), KEENAN (G. L.) & NELSON (O. A.). **Relative insecticidal Value of Commercial Grades of Pyrethrum.**—*Tech. Bull. U.S. Dept. Agric.*, no. 198, 9 pp., 8 refs. Washington, D.C., July 1930.

A series of experiments, begun in 1926 and continued at intervals for two years, are described, in which the insecticidal value of various grades of pyrethrum (*Chrysanthemum cinerariaefolium*) was tested. The following is taken from the authors' conclusions : Neither the commercial grade of pyrethrum flowers nor the locality in which the plants were grown can be accepted as giving an accurate criterion of the effectiveness of the product against insects. These experiments also show that there may be a greater difference in efficiency between two samples of the same commercial grade than between two samples of different commercial grades. Factors that may cause or influence the difference in their effectiveness, include differences in the variety of the plants or in the conditions under which they are grown, harvested or subsequently treated. It is impossible under commercial conditions to harvest the product when all flowers are in exactly the same stage of growth. Furthermore, open (mature) flowers are likely to have lost a certain proportion of the achenes (fruits), which are the most effective portion of the flowers.

Tests showed that powdered achenes are significantly more effective than the disk florets, and that the latter are more effective than the receptacles. In view of this and the fact that the greatest yield is secured when the achenes have reached maturity, it would appear that the best time to harvest the flowers would be when they are fully ripened, provided that the crop can be handled so as to avoid loss of the achenes.

PICKEL (B.). **Duas Pragas da Canna de Açucar no Estado de Pernambuco.** [Two Pests of Sugar-cane in the State of Pernambuco.]—*O Campo*, i, no. 1, pp. 47–48, 4 figs. Rio de Janeiro, January 1930.

Diatraea saccharalis, F., is the chief pest of sugar-cane in the state of Pernambuco, Brazil, but two other important ones are another moth-borer, *Castnia licus*, Dru., and the weevil, *Metamasius hemipterus*, L. The adults of *Castnia* occur from August to January, and larval mines are found in February. The larval stage lasts perhaps 9–10 months [*cf. R.A.E.*, A, xviii, 250]. The larva of *M. hemipterus*

bores into the canes, producing injuries similar to those caused by *D. saccharalis*, but occurs at the end of the rainy season when the latter is decreasing. The adult emerges from the canes from October to January.

GOBBATO (C.). **O** *Margarodes brasiliensis* **Hempel.**—*O Campo*, i, no. 6, p. 77, 1 map. Rio de Janeiro, June 1930.

Margarodes brasiliensis, Hemp., occurs in various localities in Brazil, attacking the roots of grape-vines, which are killed in a few years. It also infests plum, quince, sweet potato and other plants.

AVERNA-SACCÁ (R.). **Os entomophagos cryptogamicos na broca do cafeeiro** (*Stephanoderes hampei* **Ferr.**) **encontrados em S. Paulo.** [Entomophagous Fungi on the Coffee Berry Borer, *S. hampei*, in S. Paulo.]—*Bol. Agric.*, xxxi, nos. 1–2, 3–4, pp. 10–24, 195–213, 12 figs., 18 refs. S. Paulo, 1930.

Brief notes are given on the fungi infesting *Stephanoderes hampei*, Ferr., in Java and Borneo [*cf. R.A.E.*, A, xi, 169; xii, 524], and observations on the two species, *Botrytis stephanoderis* and *B. rileyi*, that occur in São Paulo, Brazil, are described. Laboratory infections were successful under conditions of warmth and prolonged humidity, but the latter condition would be unlikely to occur in the field. Coffee growers are, however, advised to leave in the plantations any berries infested by the fungi.

Yearbook of Agriculture, 1930.—Med. 8vo, vi+1080 pp., 219 figs. Washington, D.C., U.S. Dept. Agric., 1930. Price $1.50.

This yearbook is compiled on the same lines as previous ones [*cf. R.A.E.*, A, xviii, 380] and deals with conditions in 1929. The report of the Secretary of Agriculture (pp. 1–108) includes an account of the situation with regard to the chief pests mentioned in the preceding year's report, and also the Mediterranean fruit-fly [*Ceratitis capitata*, Wied.], and the Asiatic beetles [*Anomala orientalis*, Waterh., and *Aserica castanea*, Arr.].

Papers dealing with entomological subjects include: Asiatic Beetles of three Kinds, recent Invaders, by L. B. Smith (pp. 120–124), which gives an account of the two beetles mentioned above and of *Serica similis*, Lewis; Cotton Insect Control Measures should fit into the Farm Scheme, by B. R. Coad (pp. 197–202), in which the chief pests of the cotton belt are briefly reviewed; Japanese Beetles [*Popillia japonica*, Newm.] are caught plentifully in Geraniol-baited Traps, by E. R. Van Leeuwen (pp. 334–336), in which the standard trap is described; Lawns protected by Lead Arsenate from Beetle-grub Injury, by W. E. Fleming (pp. 348–349); Mexican Bean Beetle's Damage severe after record Winter Survival, by N. F. Howard (pp. 381–383), which includes a map showing the distribution and spread of *Epilachna corrupta*, Muls., in the eastern States from 1920 to 1929; and Pepper Weevil [*Anthonomus eugenii*, Cano] has spread steadily in southern California, by J. C. Elmore (pp. 408–410).

Lehman (R. S.). **Some Observations on the Life-history of the Tomato Psyllid** (*Paratrioza cockerelli*, **Sulc**) (**Homoptera**).—*J. N. Y. Ent. Soc.*, xxxviii, no. 3, pp. 307–312. New York, N.Y., 1930.

Paratrioza cockerelli, Sulc, is only occasionally injurious in Colorado either to tomato or potato [but *cf.* *R.A.E.*, A, xviii, 111]. The feeding of large numbers of nymphs causes wilting of the leaves of large tomato plants and the death of small ones. Observations in the laboratory showed that the length of the life-cycle varies with the temperature and at 16–27° C. [60·8–80·6° F.] occupies 25 days. A female lays an average of 75 eggs, usually near the edge on the upper surface of the leaf. The nymphs appear to be ready to feed immediately after hatching and seem to prefer the lower surface of the leaf.

Shotwell (R. L.). **A Study of the lesser Migratory Grasshopper.**—*Tech. Bull. U.S. Dept. Agric.*, no. 190, 34 pp., 13 figs., 31 refs. Washington, D.C., July 1930.

Melanoplus mexicanus, Sauss. (*atlanis*, Riley), all stages of which are described, with a key to the various instars, occurs over practically the whole of the United States, where it is the most injurious species of grasshopper, and extends southward into Mexico and northward into Canada. It is usually found in localities with light sandy soils, the wheat-stubble fields of the North-west being particularly suitable for breeding. In Montana, the eggs are usually laid during the second half of August, and as a rule show an advanced stage of development before winter sets in. The hatching period may last as long as six weeks, and begin at any time from 15th April to 15th June, after the soil temperatures have ranged above 70° F. for 6–20 hours per day over a period of about a week [*cf.* *R.A.E.*, A, xviii, 623]. One female may oviposit several times, laying, under laboratory conditions, up to 197 eggs. There are five larval instars, an extra one sometimes occurring between the regular third and fourth ; the whole larval period lasts from 30 to 50 days, according to weather conditions.

After the third instar is reached, the larvae may migrate from breeding grounds into areas with more succulent vegetation, the minimum air temperature for such migrations being 68° F. at 3 feet above the ground. The adults migrate by flight only in years when the species is abundant, large swarms covering great distances in late July, August and September. *M. mexicanus* is almost omnivorous, but prefers succulent plants, such as growing wheat and lucerne. The kernels of the former are attacked while they are in the milk stage, and the entire crop of seed of the latter may be lost owing to the grasshoppers destroying the pod before it has time to develop. In leguminous plants the green pods are preferred to the leaves. The optimum time for feeding is from 8 to 11 a.m. on clear windless days, with an air temperature of 70–80° F.

In Montana, these grasshoppers are destroyed by various wild birds, as well as by domestic fowls and turkeys. Insect enemies include the larvae of Meloid beetles and Bombyliid flies, and a Hymenopterous parasite, *Scelio calopteni*, Riley, which attack the eggs ; Sphegids and Asilids, which destroy the larvae ; and Tachinids and *Sarcophaga kellyi*, Aldr., which parasitise the larvae and adults.

For the destruction of the eggs, the author recommends autumn or spring ploughing of ground in which they occur. Poison baits

can be made more effective if the hoppers are concentrated in a small area by ploughing the infested field, from the outside towards the centre. Migrations of hoppers can be effectively checked by the use of poisoned bran mash, or by spraying or dusting with sodium arsenite.

McDaniel (E. I.). **Wood-boring Insects which attack Furniture and Buildings.**—*Circ. Bull. Michigan Agric. Expt. Sta.*, no. 134, 12 pp., 9 figs. East Lansing, Mich., May 1930.

This popular bulletin deals with the bionomics and control of the most destructive insect pests of furniture and woodwork in buildings in Michigan, namely, the termite, *Reticulitermes* (*Leucotermes*) *flavipes*, Koll., *Camponotus herculeanus pennsylvanicus*, DeG. (carpenter ant), and the powder-post beetles, *Lyctus planicollis*, Lec., *L. linearis*, Goeze, and *L. opaculus*, Lec.

Mail (G. A.). **Winter Soil Temperatures and their Relation to subterranean Insect Survival.**—*J. Agric. Res.*, xli, no. 8, pp. 571–592, 7 tables, 11 figs., 20 refs. Washington, D.C., 15th October 1930.

The following is the author's summary : A thermocouple apparatus for taking soil temperatures is described. Records of soil temperature during the winter months in Minnesota at depths from 2 to 24 ins. are analysed. Snow is normally an adequate protection from cold to insects which hibernate at depths below 4 ins. Rain or a rise in temperature inducing a thaw destroys the temperature gradient in the first 2 ft., and if such conditions are followed by a decided drop in temperature, hibernating insects may suffer high mortality. The differences in the conductivity of soils of various types are not sufficiently great to be significant in insect hibernation. Larvae and adults of *Melanotus communis*, Gyll., have a sufficiently low freezing point to withstand Minnesota winter temperatures if they hibernate below 4 ins. in the ground. Larvae and adults of two species of wireworms buried outside all winter at depths from 2 to 24 ins. practically all survived, the small mortality not being due to temperature conditions. The possibility of larvae and adults of white grubs surviving similar conditions is discussed. It is concluded that winter climatic conditions may in certain instances cause heavy mortality among hibernating wireworms.

Patterson (J. E.). **Control of the Mountain Pine Beetle in Lodgepole Pine by the Use of Solar Heat.**—*Tech. Bull. U.S. Dept. Agric.*, no. 195, 19 pp., 11 figs. Washington, D.C., July 1930.

The solar-heat method of control for bark-beetles [*cf. R.A.E.*, A, viii, 365 ; xii, 57] has proved particularly effective in dealing with the mountain pine beetle, *Dendroctonus monticolae*, Hopk., in logs of lodgepole pine [*Pinus contorta*]. The following is taken from the author's summary of his investigations during 1925–27. Bark temperatures under 110° F. are not effective. Bark temperatures of 120° or higher will kill the insects with a minimum exposure of 20 minutes. The temperatures between 110 and 120° are critical, and any temperature

within this range will kill the broods if maintained for two or three hours. Anaesthesia occurs at about 110°. Bark temperatures as high as 140° were registered when the air temperature was 89°. The mean difference between air temperatures and the concurrent bark temperatures is 40°. Killing temperatures are registered in the bark of logs exposed to direct sunlight and lying north and south, during the hours from 10 a.m. to 4 p.m., when the air temperature is 80° F. or higher. The effectiveness of the method has been demonstrated by the successful treatment of over 9,000 lodgepole pines infested with broods of the mountain pine beetle in Crater Lake National Park, Oregon. The meteorological data given apply specifically to elevations ranging between 5,500 and 6,300 feet, at 43° north latitude. The essential points in the application of the method are as follows: Logs should lie north and south and in contact with the ground. They must be limbed and topped and the brush piled or scattered away from the logs. The logs must be fully exposed to the direct rays of the sun during midday for a period of from two to five days. After the first exposure, they must be turned over in order to expose the other side. On north slopes it may be necessary to place the logs east and west and turn them twice, 120° each time. As compared with the burning treatment, the solar-heat method is cheaper, unless the slash is thoroughly cleaned up, when the cost is the same or slightly higher. When the limbs only are burned, the two methods are equal in cost. The main advantages of the solar-heat treatment are that no standing trees are scorched and no conditions attractive to insects are set up by the work, as is the case when the logs are burned. Its principal disadvantage is that ordinarily more slash is left in the forest, unless it is burned later at additional expense. Both methods are effective in killing the beetle broods.

STEINER (G.). *Neodiplogaster pinicola*, **n. sp., a Nema associated with the White-pine Weevil in terminal Shoots of the White Pine.**—*J. Agric. Res.*, xli, no. 2, pp. 125–130, 1 fig., 10 refs. Washington, D.C., 15th July 1930.

A Nematode, *Neodiplogaster pinicola*, sp. n., is recorded as living in the moist frass in mines constructed by *Pissodes strobi*, Peck, in terminal shoots of *Pinus strobus*. The Nematodes are carried under the elytra of the weevils, which explains their presence in all the mines examined; they are probably predacious on the weevil eggs and larvae.

BACK (E. A.). **Weevils in Beans and Peas.**—*Fmrs.' Bull. U.S. Dept. Agric.*, no. 1275, 30 pp., 29 figs. Washington, D.C., March 1930.

In this revision of an earlier bulletin [*R.A.E.*, A, vii, 229; xi, 259], the biology of *Bruchus quadrimaculatus*, F. (southern cowpea weevil) is given in greater detail. It is pointed out that contrary to earlier belief, the planting of seeds infested by Bruchids will not lead to infestation of the resulting crop [*cf.* xviii, 484], but that small quantities of infested beans, etc., stored in the neighbourhood may be the cause of infestation over large areas of new crops. The removal of such breeding-places is therefore of the utmost importance.

Haseman (L.), Sullivan (K. C.) & Jones (G. D.). [**Miscellaneous Pests in Missouri in 1928-29.**]—*Bull. Missouri Agric. Expt. Sta.*, no. 285, pp. 70–76. Columbia, Mo., April 1930.

In experiments with insecticides for controlling pests of cucurbits it was found that a dust of 1 lb. calcium arsenate and 15 lb. gypsum, applied regularly from the time the plants came up until they began to blossom, gave the best results and caused the least injury to the plants. Sunflowers were found to be attacked by a number of pests, including a Tortricid, *Suleima helianthana*, Riley, and *Rhodobaenus tredecimpunctatus*, Ill. (stalk weevil). In the tests conducted in 1928 to compare the value of various dusts with that of the regular spray of 2 lb. lead arsenate to 50 U.S. gals. water against the codling moth [*Cydia pomonella*, L.], curculio [*Conotrachelus nenuphar*, Hbst.] and various diseases of apple [*R.A.E.*, A, xviii, 572], the largest amount of uninjured fruit was obtained from a plot treated with a dust of lead arsenate and sulphur, 15 : 85, alone. A great amount of foliage injury was caused by a dust of 70 per cent. lime, 20 per cent. dehydrated copper sulphate and 10 per cent. lead arsenate. Observations on the biology of *Tyloderma fragariae*, Riley, on strawberry [*loc. cit.*] show that oviposition began during the middle of April, a few days after mating had taken place. Females that began egg-laying in April were still laying on 6th July, eggs being deposited at an average rate of one every other day. The incubation period varied from 11 to 21 days.

Van Leeuwen (E. R.) & Metzger (F. W.). **Traps for the Japanese Beetle.**—*Circ. U.S. Dept. Agric.*, no. 130, 16 pp., 6 figs. Washington, D.C., July 1930.

The trap for the Japanese beetle [*Popillia japonica*, Newm.] described and illustrated is an improved form of one already noticed [*R.A.E.*, A, xvii, 421], the modifications including changes in the size and in the construction of the baffle and bait container. The bait previously used has been altered by increasing the amount of geraniol to four teaspoons and the eugenol proportionately to half a teaspoon. A sticky substance smeared on paper and placed around the cylinders of the traps greatly increased their efficiency, about 65 per cent. more beetles being caught. It can be prepared by heating 5 lb. resin and 3 U.S. pts. castor oil until the resin is melted. Most of the beetles extricate themselves from the adhesive, but become so smeared with it that they cannot fly. Thus the device is not rendered useless by being covered with insects. Traps painted green were found to attract more beetles than those of any other colour. They should not be suspended among foliage, but from posts or standards so that the top of the funnel is at a height of 3 or 4 feet, and should be exposed to strong sunlight. More than 9,000,000 beetles were destroyed by 500 traps on an area of 15 acres during 1929.

Gray (W. L.). **The Sugarcane Mealybug in Mississippi.**—*Quart. Bull. Mississippi Pl. Bd.*, x, no. 1, pp. 12–13. A. & M. College, Miss., April 1930.

In 1929, the sugar-cane mealybug [*Pseudococcus boninsis*, Kuw.] was found on sugar-cane in four neighbouring localities in Mississippi. The cane concerned had all originated from a consignment imported

from Louisiana in 1927. As these are the only infestations known in the State, it is hoped to eradicate them by destroying all crop residues, etc., preventing the use of infested cane as seed, and not planting cane on the infested area for at least two years. Though sugar-cane is a minor crop in Mississippi, it is likely to be of increasing importance, and the mealybug, when associated with the Argentine ant [*Iridomyrmex humilis*, Mayr], of which there are nearly 200 infestations in the State, may become a serious pest.

LATHROP (F. H.) & NICKELS (C. B.). **A comparative Study of dusting by Means of Airplane and Ground Machine for the Control of the Blueberry Maggot.**—*Circ. U.S. Dept. Agric.*, no. 123, 14 pp., 3 figs., 5 refs. Washington, D.C., August 1930.

Preliminary experiments in Maine, during 1925–27, showed that lead or calcium arsenate dust is effective in controlling *Rhagoletis pomonella*, Walsh, on blueberries by killing the adults before oviposition. Further experiments were conducted on a larger scale during 1928, calcium arsenate dust being applied by means of an aeroplane and a ground machine. Under favourable conditions of atmosphere and topography, dusting by aeroplane, from a height of not more than 20–25 ft., was as effective as dusting by ground machine, but under the usual conditions, somewhat better results were obtained with the ground machine. As a result of these tests, the use of calcium arsenate against *R. pomonella* is recommended.

The calcium arsenate used should contain not less than 40 per cent. total arsenic pentoxide and not more than 0·75 per cent. water-soluble arsenic, and should have a density of between 80 and 100 cu. ins. to the pound. It should be applied at the rate of 6–7 lb. to the acre and as evenly as possible to minimise the danger of injury to the plants. The best results were obtained by dusting early in the morning (3–8 a.m.), when there was no wind and the plants were covered with dew. On land that produces a sufficiently large crop to justify the expense, two applications are advisable, the first between 13th and 20th July and the second 7–10 days later. Applications should be completed before 1st August, the last being made two weeks before the fruit is harvested. Where only one application is desirable, dusting should be carried out between 18th and 24th July. In abnormally early or late seasons, it is considered best to begin the first application as soon as the first larvae appear in the ripening fruit. It is desirable to dust as large an area as possible, as this reduces the danger from flies coming in from untreated areas. As far as possible, no untreated plants should be left round the borders of the dusted areas. The cost of one application with horse-drawn power dusters, including every expense except the price of the insecticide, is estimated at 4*s*. 2*d*. an acre.

BACK (N. A.). **A Study of the economic Costs of Quarantines in New Jersey.**—*Circ. New Jersey Dept. Agric.*, no. 182, 47 pp., 4 charts. Trenton, N.J., June 1930.

A survey during the years 1918 to 1929 shows that the total cost of administering the quarantines against the Japanese beetle [*Popillia*

japonica, Newm.], the Asiatic beetle (*Anomala orientalis*, Waterh.) and the Asiatic garden beetle (*Aserica castanea*, Arrow) in New Jersey for these twelve years was about £225,800. From the growers' point of view, it is known that the cost of meeting quarantine regulations represents approximately one-fifth of the total net income of certain large nursery and greenhouse establishments.

Gross (C. R.) & Fahey (J. E.). **Some of the Chemical Problems in Codling Moth Control.**—*Northwest Fruit Grower*, May–June 1930, pp. 7, 22.

The authors review briefly some of the outstanding problems that confront the insecticide chemist, particularly with reference to the control of the codling moth [*Cydia pomonella*, L.] in the north-western United States, and the progress that has been made in their solution. It is known that insecticidal properties are associated with compounds of certain metals such as lead and copper, and with certain of the salt-forming non-metallic elements, such as arsenic in the form of the arsenate, and fluorine in fluoride or fluosilicate forms ; they are also exhibited by certain organic compounds with a very complicated structure such as nicotine, the pyrethrins and rotenone. The insecticide chemist endeavours to combine these chemicals in new ways designed to form compounds of increased toxicity and practical utility. A sodium fluoaluminate, which is commercially manufactured as artificial cryolite, has been shown to have marked insecticidal properties when freshly applied against *C. pomonella*, but its effectiveness decreases more rapidly than that of lead arsenate. Potassium fluoaluminate shows a promising degree of toxicity, but requires further testing as to duration of effectiveness. Rotenone, which is obtained by ether extraction from the root of *Derris elliptica* and subsequently purified by recrystallisation from alcohol, is being studied. Unless this material can be used in very high dilutions as a spray, its cost is rather prohibitive. When its chemical structure, which at present is not understood, has been proved, studies will be made to produce it more cheaply by artificial means. Laboratory experiments have shown it to be 30 times as toxic as lead arsenate to silkworms [*Bombyx mori*, L.]. Mixtures of this and other substances are also being tested.

In studies made in late summer on the foliage injury that results when an oil spray follows too closely after a sulphur spray, it was found that the same type of injury was produced by liquid and dry lime-sulphur, wettable sulphur and even flowers of sulphur. The addition of 5 lb. hydrated lime to each 100 U.S. gals. of spray containing $\frac{3}{4}$ per cent. actual oil made it possible to spray safely a few days after the sulphur sprays had been applied. It is presumed at present that the injuries are the result of certain sulphur products present in the partly decomposed and incompletely oxidised lime-sulphur deposits, and it is believed that these dissolve in the oil and are thereby carried into the leaf tissues. The exact part played by the hydrated lime is not yet understood. Various materials are to be tested with regard to their capacity for preventing sulphur injury when incorporated with the oil.

Experiments with a view to increasing the permanence of nicotine residue after nicotine spraying showed that a nicotine and oil combina-

tion held the nicotine better than any other combination tried. Nicotine tannate (an insoluble nicotine compound) when applied with fish-oil retained its nicotine content quite effectively. Maize syrup and glycerine when added to nicotine sulphate caused the nicotine residue to remain longer than when nicotine sulphate was applied alone, but not so long as did the nicotine tannate and fish-oil combination. Nicotine oleate gave poor control and scorched the foliage. The degree of control was found to be correlated in general with the amount of nicotine residue remaining on the foliage.

Spray residue on fruit is much more successfully dealt with than in the past by improved acid washing processes and by carefully planned spray schedules. Studies are, however, being made to increase still further the efficiency of the washing solutions by means of mixed solvents. It was previously found that the solvent action of hydrochloric acid was considerably increased by the addition of certain sulphates and chlorides [*R.A.E.*, A, xviii, 356]. In the present investigations sodium chloride (common salt) was found to be the most efficient and the cheapest of the salts tried, but it cannot be expected to be very effective late in the season after the apples have become waxy, and various oil solvents were therefore added to the hydrochloric acid in order to dissolve off a portion of the waxy coating. The tests with these are described. Kerosene emulsified with kaolin proved the most efficient for the purpose ; it is cheap and easily emulsified and caused no injury, but would probably not be safe to use except on waxy fruit. The use of salt or kerosene cannot be advocated for commercial washing operations until further experience is gained with them.

Back (E. A.), Cotton (R. T.), Young (H. D.) & Cox (J. H.). **The Use of Ethylene Oxide-Carbon Dioxide Mixture for treating stored Grain.**—Multigraphed, 10 pp., 4 pls. [Washington, D.C., U.S. Dept. Agric., 1930.]

The properties of ethylene oxide mixed with carbon dioxide as a fumigant against grain pests have previously been tested [*R.A.E.*, A, xviii, 408]. The form of carbon dioxide that has been found most satisfactory for this purpose is "dry ice," which is a white solid, easily crushed, having a temperature of –110° F., and which, on exposure to air, slowly changes from a solid to a vapour. Before use it is broken up into small pieces and the ethylene oxide is poured over it at the rate of 1 lb. to 10 lb., being either measured out of the cylinder by a gauge or weighed out. The mixture should be stirred a little so that all the liquid is taken up by the dry ice ; 33 lb. is sufficient for treating 1,000 bushels of grain. It may be applied by shovelling it into the stream of grain running into the bin or by the use of various machines. In order to counteract leakage at the bottom and top of a bin, the dosage for the first 1,000 and the last 500 bushels is made proportionally greater. Observations on commercial fumigation of grain in elevator bins, which are recorded in detail, showed that 100 per cent. mortality of the rice weevil, *Calandra* (*Sitophilus*) *oryzae*, L., which was used experimentally, was generally obtained. No impairment of the milling or baking qualities of the wheat resulted from the treatment, and the fumigation of grain in bulk did not materially affect its germination. If, however, small quantities of wheat are

fumigated in large containers, the absorption of ethylene oxide undoubtedly seriously reduces the germination, and this method should not be used for small quantities of wheat intended for seed.

Wellman (V. E.) & Tartar (H. V.). **Factors controlling Water-Soap-Oil Emulsions.**—*J. Phys. Chem.*, xxxiv, pp. 379–409. Ithaca, N.Y., 1930. (Abstract in *Bull. Chem. Res. Pat. Inf., Ass. Brit. Insecticide Manuf.*, ii, no. 6, p. 13. London, June 1930.)

The distribution of soap emulsifiers between the immiscible phases of emulsions is a type-determining factor of such systems. Moreover, distribution of soap is controlled by factors influencing solubility and ease of wetting, *e.g.*, temperature, phase-volume, relationships, mechanical treatment, the presence of electrolytes, etc. Oil-in-water emulsions are stabilised by soaps that are chiefly present in the aqueous phase; the soaps are probably colloidal at the interfaces of such emulsions. Soaps that are more easily wetted out by the "oil," or are chiefly in solid or colloidal condition in the non-aqueous phase, temporarily stabilise water-in-oil emulsions. The concentration of soap at emulsion interfaces may be regarded as constituting a third phase of the system.

Smith (C. R.). **Neonicotine.**—*Oil, Paint & Drug Reporter*, cxvii, no. 16, p. 380. New York, 1930. (Abstract in *Bull. Chem. Res. Pat. Inf., Ass. Brit. Insecticide Manuf.*, ii, no. 9, p. 19. London, September 1930.)

The author has communicated to the American Chemical Society the results of his researches on the reaction between pyridine, sodium and oxygen. From among the substances formed, he has isolated β-pyridyl α-piperidine, soluble in water and having properties similar to those of nicotine. Until more is known about the actual character of the latter substance, this new body, to which the author has given the name of neonicotine, may be assumed to have this constitution. The new substance is a very powerful insecticide, equal and perhaps superior to nicotine itself.

Nelson (O. A.). **Vapor Pressures of Fumigants. IV.—1, 1, 2, 2-Tetra-, Penta-, and Hexachloroethanes.**—*Indust. Engng. Chem.*, xxii, no. 9, pp. 971–972, 6 refs. Easton, Pa., 1st September 1930.

A number of alkyl chlorides have been tested by different investigators for their effectiveness as fumigants. Tetra- and pentachloroethanes have shown some promise against certain pests, while hexachloroethane has been suggested as a possible substitute for naphthalene and paradichlorobenzene against moths. Results are here given in tables on the vapour pressures of the first two from room temperatures to above their boiling points and of hexachloroethane from room temperature to about 60° C. In fumigating work it is essential to know how much of a certain fumigant can vaporise into a fumigating chamber of a given size. In previous papers [*R.A.E.*, A, xvii, 729], of which the third was erroneously numbered IV, formulae were given by which these calculations can be made.

WOODMAN (R. M.). **Wetting, Spreading and Emulsifying Agents for Use with Spray Fluids. I. Wetters and Spreaders.**—*J. Soc. Chem. Ind.*, xlix, no. 7, pp. 93T–98T, refs. **II. Emulsifiers.**—*T.c.*, pp. 193T–197T, refs. London, 14th February & 18th April 1930.

A wetter may be defined as a substance that causes a spray fluid to wet the sprayed surface so that collecting into droplets is avoided, and a spreader as one that causes the film of spray fluid to extend over parts of the surface that have not been directly hit by the spray. Three tensions are involved in the wetting of a solid surface by a liquid, but owing to the impossibility of measuring the tensions between solid and liquid (except in a few special cases) and solid and air, observations have been directed to that between liquid and air, commonly referred to as surface tension of the liquid. When this tension is lowered wetting of the surface is obtained.

Experiments were carried out with a view to determining the relative efficiency of various substances that might act as wetters or spreaders by measuring the liquid/air tension, but it is pointed out that discrepancies may occur between laboratory results and spraying practice owing to the two other tensions. Moreover, the tension fluid/air is measured in the laboratory on a clear or filtered solution, and such measurements may give an inadequate conception of wetters and spreaders in actual practice. The surface tensions of these substances are indicated in tables.

Potassium oleate, sodium resinate, "perminal" (Agral I), and the mixed salts from bile (sodium taurocholate and sodium glycocholate) were the best wetters and spreaders. Soap would be ideal were it not for the fact that it is insoluble in brine and reacts with the salts that cause hardness in water and with many toxic substances. Soluble resinates possess the advantage over soaps of being more soluble in brine, and would be slightly preferable for natural brine waters. Small amounts of salt do not affect a 1 per cent. sodium resinate solution, but increasing quantities lower the surface tension beyond that of a 2 per cent. sodium resinate solution. The surface tensions of many of the substances largely used in the field as wetters and spreaders indicate that they are not of any great value, but, as pointed out above, factors other than surface tension may be involved in practice. Although barium caseinate has a moderately high surface tension, it would probably serve the dual purposes of a stomach poison and of a wetter, spreader, emulsifier, or protective colloid for suspensions.

Many saturated aqueous solutions of liquids possess a surface tension considerably lower than that of water, even though the liquids are so slightly soluble as to be termed immiscible with water. Some of these liquids, such as aniline, cresylic acid, amyl alcohol and pyridine, are often found in proprietary sprays, and in addition to their toxic action must confer wetting and spreading powers on the washes. Liquid wetters and spreaders would probably in general possess the advantage of being unaffected by hard waters.

In the second paper the author discusses emulsifiers [*cf. R.A.E.*, A, xvi, 423]. Experiments in which 10 cc. toluene was emulsified with 5 cc. of 1 per cent. solutions of sodium resinate in water of varying degrees of hardness showed that this emulsifier gives the correct type of emulsion in water of 30 degrees of hardness (calculated as $CaCO_3$) despite the presence of precipitated resinate, but dilution to a spraying

concentration of oil (approximately 1–10 per cent.) with unsoftened water would entail risks of inversion. Emulsification with 1 per cent. sodium resinate was easier in waters containing a certain amount of sodium chloride. Emulsification of toluene was easy with solutions of potassium oleate of 0·75–2 per cent. and more difficult with more dilute ones. Benzene appears to be more easily emulsified with this than toluene.

Detailed results of a comparison of various emulsifiers of possible use in the preparation of stock spraying emulsions (most of which were also used in the tests on wetters and spreaders), employing oils representative of all types used for spraying and weed destruction and waters of known degrees of hardness and pseudo-hardness, are tabulated. It was found that an efficient wetter and spreader is not always a good emulsifier and *vice versa.* At 50 per cent. concentration of oil, certain oils, including anthracene oil can be emulsified to give emulsions of value as sprays (at least if the emulsion is used as soon as it is made) in all types of hard water.

An emulsion of anthracene oil corresponds to winter sprays of emulsified coal-tar fractions. These oils are usually obtained as miscible oils but might be supplied commercially as stock emulsions, provided that a suitable emulsifier could be found and a sufficiently concentrated emulsion produced. Preliminary experiments with various emulsifiers showed that a 2 per cent. aqueous solution of saponin gave perfect and moderately stable 80 per cent. emulsions of anthracene oil and of this oil mixed with an equal volume of other oils, such as tetralin or rape oil. Diluted emulsions made from the 80 per cent. stock emulsions immediately after preparation of the latter are quite stable even in waters of excessive hardness such as would not be found anywhere in England. The author points out that the addition of 20 per cent. high boiling phenols to the high boiling neutral material in Tutin's experiments did not materially modify the toxicity of the latter to insect eggs [*R.A.E.*, A, xvi, 584] and as anthracene oil should be that fraction of coal tar boiling above 270° C., it should correspond to Tutin's mixture of high-boiling neutral material with high-boiling phenols. If this is so, emulsions of this oil should have similar ovicidal properties and yet eliminate the necessity for removing the tar acids (phenols). The experimental emulsification of mixtures of anthracene and other oils was undertaken with the idea that such mixtures might counteract the relative inefficiency of the coal-tar fraction against Capsid eggs and red spider [*Paratetranychus pilosus*, C. & F.].

NEWTON (W.) & HASTINGS (R. J.). **A new Sulphur-resin Spray.**—*Sci. Agric.*, xi, no. 1, pp. 26–28. Ottawa, September 1930.

Studies on the toxicity of solutions of resin and sulphur towards fungi have resulted in the development of a new spray, which is also an effective contact insecticide. After various trials, a standard mixture was adopted consisting of 4 lb. sulphur, 4 lb. resin, 7 lb. potassium hydroxide and 1 lb. water. Sufficient heat is generated by the mixture to fuse the ingredients, which should be stirred vigorously while mixing to prevent charring. A granular mass is thus obtained that dries to a granular powder if spread out into thin layers before the fuse cools. This dissolves readily in cold water as a clear solution without further mechanical grinding. Both as fungicide and insecticide, 16 lb. of the powder to 200 gals. of water was found to be a

satisfactory strength. The spray spreads evenly over foliage, adheres well, and has no conspicuous colour. Tulip leaves remained uninjured even with much stronger concentrations, but young hop leaves were slightly injured at the effective strength. The spray instantly killed Aphids and mites on the foliage.

Uichanco (L. B.). **Biological Notes on Adult** *Leucopholis irrorata* **Chevrolat, with a Consideration of Beetle Collecting Campaigns as a Method of Control against White Grubs.**—*Philipp. Agric.*, xix, no. 3, pp. 133–155. Laguna, P.I., August 1930.

An account is given of investigations to test the value of collecting adults of *Leucopholis irrorata*, Chevr., in order to lessen the damage done by the larvae, which are much the most injurious of various species of white grubs attacking sugar-cane in the Philippines. The conclusion reached is that the co-operative collection of beetles is of little value ; it is pointed out that even if all the beetles caught were females, the number of inaccessible food-plants prevents anything like complete collection, while the limited areas in which the soil is favourable for oviposition narrows the centres of reproductive activity of the surviving gravid females. From examination of the catches in a number of districts, the indications are that 69–78 per cent. of the beetles caught are males. During the first few days after the initial appearance of large numbers of adults, the remaining percentage is largely composed of gravid females, but these are soon replaced by spent females. As the males are able to fly considerable distances (at least 3 miles), their destruction in any locality is quickly followed by the immigration of others. The adults themselves do very little damage. The females examined contained an average of 3·11 to 5·2 eggs each, the indications being that many females finish oviposition within 5 days from the mating flight, and die soon afterwards. The proportion of males to females in the open was highest within 3 days from the initial occurrence of the large brood of the year in a given locality, many females apparently remaining in the ground for oviposition ; it was low five days later because many females had become spent and returned to the open, and was high again a month later, probably because the later broods were small and many of the old females had died.

Certain other practices might have greater success in reducing damage by the grubs. The actual factors encouraging oviposition in any area are not fully understood, but there seems to be a persistent correlation with soil pockets or depressions in which organic material is periodically deposited by floods during the rainy season. It might be possible to obviate the formation of these foci of infestation by artificially diverting flood water by drainage canals, or by applying to the areas protective substances such as coal-tar kerosene emulsion. This acts as both an insecticide and repellent and remains effective in the soil for as long as two months. As soon as infestation is discovered, the infested area might be isolated by a shallow trench saturated with the emulsion, in order to prevent the larvae spreading to other parts of the field. As a supplementary measure, the alternative favourite food-plants of the adults, particularly *Spondias purpurea* and mango, growing in the vicinity of oviposition sites, should be sprayed with an arsenical. The leaves of these trees are devoured by the females as soon as they issue from the ground. It might even be

advisable to plant them in fields that are regularly infested. Spraying should begin when emergence in any numbers is first noticed, and be repeated until the ovipositing females have become scarce.

Philippine Islands Department of Agriculture. Bureau of Plant Industry. Administrative Order No. 2.—*Philipp. J. Agric.*, i, no. 1, pp. 135–138. Manila, 1930.

This Order, dated 13th January 1930, prescribes measures for the control of *Promecotheca cumingi*, Baly, which is declared a dangerous pest of coconuts in the Philippines. In infested areas, the beetles are to be caught with nets early in the morning and destroyed, and in cases where hand collection present difficulties, spraying with soap solution at the rate of $\frac{1}{4}$–$\frac{1}{2}$ lb. to 4 gals. water, preferably with the addition of nicotine sulphate, is enjoined. As an alternative, calcium or lead arsenate may be used with soap or some other adhesive. The spray should be directed to the lower surfaces of infested leaves where the beetles congregate. A hole of about 1 cubic yard is to be dug for every 50 trees attacked, filled with infested leaves and covered with 16-mesh wire gauze to allow parasites to escape. The infested leaves must be changed at least once in 10 days.

Hammond (A. A.). **Codling Moth Control. Spraying Tests.**—*J. Dept. Agric. Victoria,* xxviii, pt. 7, pp. 400–420, 2 plans. Melbourne, July 1930.

Experiments in 1929–30 to determine the value of certain sprays, chiefly proprietary arsenicals and oils, in the control of the codling moth [*Cydia pomonella,* L.] in Victoria were conducted in two orchards, one containing apples and the other pears. Infestation was very light in the early part of the season ; the moths appeared very late, and the infestation of pears was unusually severe. It was observed that 99 per cent. of the larvae of the first generation entered the pears through the calyx end, whereas only 1 per cent. entered the apples at this point, the majority of the larvae of the last generation entered the pears through the side. Tests of the previous season suggested that arsenical calyx sprays followed by an oil spray do not give an effective control [*cf. R.A.E.*, A, xviii, 107] ; the tests under review indicated that a lead arsenate calyx spray followed by a combined spray of oil and arsenate will give effective control against the first brood. The combined spray will also control mites and Coccids. Providing that there is no re-infestation from a neighbouring orchard, the control of the late broods in a normal season would be comparatively easy if an arsenical spray combined with a white oil were used to control the first brood.

The use of molasses baits in connection with these experiments suggest that they are not only helpful in indicating the activities of the moths but are also of considerable importance as a direct means of control. The baits were exposed in 2 pt. earthenware fern pots, with a flange around the top, placed high up in the trees, and consisted of crude molasses diluted with 16 parts water to which brewer's yeast was added at the rate of 2 tablespoons to the gallon. It was later determined, however, that baits to which no yeast had been added were equally effective. Between 22nd October and 13th December, 448 moths were trapped in 8 pots, 6 of which were only used up to

15th November. Of the moths examined 75 per cent. were females; these contained numbers of eggs. In the warm weather it is considered advisable to renew the baits every week. Some other insects were taken in the pots, but they did not include any beneficial species.

Cock (S. A.). **Fumigation of Citrus Trees. Results of six Years' Work.**—*J. Dept. Agric. Victoria*, xxviii, pt. 7, pp. 445–448. Melbourne, July 1930.

Since the fumigation of *Citrus* trees, owing to the failure of oil emulsions and other sprays against the red scale [*Chrysomphalus aurantii*, Mask.] in Victoria, has been made compulsory, some 193 thousand trees have been fumigated by Government outfits, at an average cost of 2*s.* 2¾*d.* per tree. Calcium cyanide is now used for all trees, the G. fumigant (granules) being employed for lemons [*cf. R.A.E.*, A, xv, 176], at the rate of 1 oz. to 100 cu. ft. The operations should begin, according to the condition of the young fruit, usually late in December or early in January, provided that the temperature is not lower than 50° F. and the humidity is less than 75 per cent., and should end late in April or early in May, by which time, owing to the weather conditions, there is a danger of injury to the foliage and fruit. The work is done at night.

It is not often possible to obtain complete control with one fumigation owing to factors such as unsuitable weather and the resistance of the scale at certain periods of its growth. Any trees showing signs of infestation a year after fumigation should be sprayed (during January or February) with a white oil emulsion. In some localities the scale has infested shrubs, deciduous fruit trees and vines growing near *Citrus*; spraying the infested plants during the dormant season with an oil emulsion of the usual winter strength is recommended.

Gourlay (E. S.). **Preliminary Host-list of the Entomophagous Insects in New Zealand.**—*Bull. N.Z. Dept. Sci. Indust. Res.*, no. 22, 13 pp., 56 refs. Wellington [N.Z.], 1930.

This list of parasitic and predacious insects of New Zealand indicates their distribution in other countries, the insects they attack and the stages concerned. General notes are given on the identity and habits of certain species.

Leefmans (S.). **Een *Rhynchites*-larf as mineur in theebladeren.** [A Larva of *Rhynchites* mining in the Leaves of Tea.]—*Arch. Theecult. Ned.-Ind.*, 1930, no. 3, pp. 143–151, 8 figs. Buitenzorg, 1930. (With a Summary in English.)

A blistering of the epidermis of old leaves of tea has been observed in Sumatra, about ten acres being severely affected. It is due to mining by the larva of *Rhynchites* sp.* The infested leaves do not drop off, but the larvae leave them to pupate in the soil. The legless larvae are yellow and 5–6 mm. long. The pupal period appears to be a short one. The adults are about 4·5 mm. long, steel blue in colour, and rather thickly covered with long white hairs. This new pest probably originated in some wild food-plant.

* We are informed by the author that this is a misidentification, the weevil in question belonging to the allied genus *Eugnamptus*.—Ed.

VERBEEK (F. A. T. H.). *Xyleborus morigerus* **Blandf. als kiemplant-boeboek.** [*X. morigerus* as a Shot-hole Borer of Nursery Plants.] —*Arch. Theecult. Ned.-Ind.*, 1930, no. 3, pp. 152–170, 4 figs., 10 refs. Buitenzorg, 1930. (With a Summary in English.) Abridged as **Kiemplant-boeboek in thee.**—*De Bergcultures*, iv, p. 402 (reprint 3 pp.). [? Batavia] 19th April 1930.

During the last few months of 1929, tea plants, especially in the nursery, were attacked in various parts of Java by a shot-hole borer, *Xyleborus morigerus*, Bldf., all stages of which are described. The females usually bore into the tap-root, at any depth up to a foot below the surface of the soil, a few such attacks being sufficient to kill the plant. A brood-chamber is hollowed out, and the eggs are laid there. Later on, especially in thicker stems, galleries branch off until the whole of the wood is perforated. Larvae, pupae and adults occur in these mines, but no eggs.

Other recorded food-plants of this Scolytid are coffee, cacao, cinchona, *Cola nitida*, *Erythrina lithosperma*, *Melia*, *Leucaena glauca*, diseased *Hevea*, dying *Ficus*, teak, *Schleichera trijuga*, mahogany, *Desmodium*, *Crotalaria anagyroides*, *Tephrosia maxima*, and *Cassia multijuga*. Though statements in the literature are conflicting, the author's observations indicate that *X. morigerus* specially infests plants in shade. This may be a reason why the mines are usually on one side of the stem. Burning infested plants at intervals of a week might be of some value in control.

VERBEEK (F. A. T. H.). **De Djativlinder** (*Hyblaea puera* **Cram.**). [The Teak Moth, *H. puera*.]—*Tectona*, xxiii, pp. 104–112. Buitenzorg, 1930. (With a Summary in German.)

The author criticises certain points in Zondag's paper on *Hyblaea puera*, Cram., in the Dutch East Indies [*R.A.E.*, A, xviii, 194], and suggests that further investigations are necessary before an accurate estimate can be made of the damage done to teak, especially as other insects, such as the grasshopper, *Valanga nigricornis*, Burm., are responsible for part of the defoliation.

VERBEEK (F. A. T. H.). **De Canthariden op Java.** [Meloid Beetles in Java.]—*Tectona*, xxiii, pp. 304–308, 2 pls. Buitenzorg, 1930. (With a Summary in English.)

The Meloid beetles, *Epicauta ruficeps*, Ill., *Mylabris pustulata*, Thunb., and *M. cichorii*, L., are briefly described. The larvae of the first two are known to infest the egg-pods of *Valanga nigricornis*, Burm., in Java, and the third also probably does so. Each larva requires one egg-pod for its development, thus destroying from 40 to 70 eggs. Adults of *E. ruficeps* occur in teak forests from December to May, and those of *M. pustulata* from December to August. In some years they are very abundant. Both species of *Mylabris* appear to feed in the adult stage on the flowers of various plants, and perhaps also on the half-ripe fruits. *E. ruficeps* seems to feed exclusively on the leaves, maize being one of the plants attacked.

VERBEEK (F. A. T. H.). **Enkele aanteekeningen over den kever** *Epicauta ruficeps* **Ill.** [Some Notes on *E. ruficeps*.]—*Natuurk. Tijdschr. Ned.-Ind.*, xc, pp. 85–92. Batavia, 1930.

Epicauta ruficeps, Ill. [see preceding paper] oviposits in the ground. On hatching, the young triungulin larva, which is very active and can live for a long time without food, searches for the egg-pods of *Valanga nigricornis*, Burm., and possibly other grasshoppers, within which it feeds and undergoes hypermetamorphosis. After the last moult, the larva burrows deeper into the ground and passes through a rest-period before pupating. The adults appear about December and live for about four months, sometimes causing extensive injury to crops. The abundance of this Meloid varies in different years and appears to depend on the number of grasshopper eggs.

KUIJPER (J.). **Kalkarsenaat vergeleken met loodarsenaat als bestrijdingsmiddel tegen rupsen in Deli tabak.** [Calcium Arsenate compared with Lead Arsenate for combating Caterpillars on Tobacco in Deli.]—*Vlugschr. Deli Proefst.*, no. 52, 4 pp. Medan, July 1930. Also in *Algem. LandbWkBl. Ned.-Ind.*, xv, no. 6, pp. 161–162. Bandoeng, 9th August 1930.

Field experiments with insecticides against Lepidopterous pests of tobacco in Deli, Sumatra were continued in 1930 [*cf.* *R.A.E.*, A, xviii, 339], dusts of calcium arsenate and lead arsenate being used. The latter proved definitely superior, and is less injurious to the leaves.

GEORGI (C. D. V.) & CURTLER (E. A.). **The periodic Harvesting of Tuba Root** (*Derris elliptica*, **Benth.**).—*Malayan Agric. J.*, xvii, no. 9, pp. 326–334. Kuala Lumpur, September 1929.

The results of an investigation into the variations in the amounts of ether extract obtained from *Derris elliptica* of varying ages show that if both the yield of the root and the amount of ether extract is considered, the optimum age for harvesting is when the plants are 25 months old.

GEORGI (C. D. V.). **Variations in the Amount of Ether Extract of Tuba Root** (*Derris malaccensis*, **Prain**).—*Malayan Agric. J.*, xvii, no. 10, pp. 361–363. Kuala Lumpur, October 1929.

The results of analysis show that the amount of ether extract obtained from the erect form of *Derris malaccensis* is greatly in excess of that from *D. elliptica*. The optimum age for harvesting appears to be when the plants are 23 months old.

PAGDEN (H. T.). **A preliminary Account of three Rice Stem Borers.**—[*Bull.*] *Dept. Agric. S.S. & F.M.S.*, Sci. Ser. no. 1, 30 pp., 1 pl., 7 figs., 5 refs. Kuala Lumpur, June 1930.

A detailed account is given of the bionomics of *Diatraea auricilia*, Dudg., *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) and *Sesamia inferens*, Wlk., attacking rice in Malaya [*cf.* *R.A.E.*, A, xviii, 593], and all stages of these moths are described. The larvae of *D. auricilia* hatch in 4–7 days, and usually pupate after a month, the pupal period

lasting 4–12 days. They normally develop in growing rice stems, but can live and feed in damp stubble provided that it is not rotten. The incubation period of *Schoenobius* lasts 5–7 days, the larval about 35 and the pupal about 8–12. The eggs of *Sesamia* hatch in 4–5 days ; the average larval period for 29 individuals lasted 42·5 days, and the pupal period for 27 individuals 10·7 days. *Schoenobius incertellus* has not been found on any food-plant other than rice ; *Sesamia* feeds on maize, sugar-cane, *Paspalum commersoni* and, experimentally, *Eleusine indica*, and *D. auricilia* on maize and *Scirpus grossus*. The last-named plant, which is also occasionally attacked by *Sesamia*, is allowed to grow up after the rice harvest and is cut down below the water level and allowed to rot, thus providing manure for the following planting season. Examination showed that larvae of *Diatraea* were present in the sheathing leaves and in the stems, and healthy larvae were found a foot below the surface of the water ten days after the rice-fields had been flooded.

As suggested methods of controlling these borers, which include flooding, the use of light traps and alteration in the time of planting, do not appear likely to be of much value, attention has been directed to the possibility of utilising indigenous parasites [see next paper]. The species observed parasitising the eggs of *D. auricilia* were *Trichogramma nanum*, Zehnt., a Scelionid, ? *Phanurus beneficiens*, Zehnt., and possibly a Mymarid, ?*Paranagrus optabilis*, Perk., which may, however, have been parasitising Fulgorid ova underneath the egg mass from which it appeared to emerge. The Braconid, *Apanteles flavipes*, Cam., was reared from the larvae and a Chalcidoid from the pupae. The only parasites obtained from *Schoenobius bipunctifer* were *T. nanum* and *Phanurus beneficiens*, attacking the eggs, and a Nematode, *Mermis* sp., recorded from an adult. No egg parasite has been recorded from *Sesamia inferens*, but *T. nanum* will attack exposed eggs in the laboratory. The Tachinid, *Winthemia semiberbis*, Bezzi, and an Ichneumonid, *Xanthopimpla* sp., have previously been reared from the larvae and pupae respectively. The Chalcid obtained from the pupae of *D. auricilia* also parasitises a high percentage of those of *Sesamia*, which usually occur outside the stem of the rice plant, more than 60 individuals being found in one pupa.

Of the two egg parasites, *Trichogramma nanum*, the immature stages of which are described, was found to be easily handled and to attack readily the eggs of *Sitotroga cerealella*, Ol., but at first the parasites obtained from such ovipositions were smaller than the original brood, and the percentage of parasitism decreased for each generation. When the weakly parasites were supplied with ova of *D. auricilia* before they reached complete exhaustion, however, the ensuing generation was found to regain its vitality completely. The loss of vitality was thought to be due to the parasites receiving insufficient nourishment, but later they were found to be adapting themselves to breeding in the eggs of *Sitotroga*. In the laboratory it is difficult to obtain a high percentage of parasitism with *Schoenobius* unless the covering of scales is removed from the egg-mass. The female parasite may oviposit immediately after emergence, pair and then continue egg-laying. The life-cycle from egg to adult lasts 6–8 days. From 1 to 15 larvae may be found in a single parasitised egg ; this may be due to polyembryony or more probably to several females ovipositing in the same host egg owing to the confined space in the laboratory.

MILLER (N. C. E.) & PAGDEN (H. T.). **An Attempt to control Padi Borers.**—*Malayan Agric. J.*, xviii, no. 7, pp. 334–340, 1 pl., 3 refs. Kuala Lumpur, July 1930.

Much of this information on the control of rice borers in Malaya has been noticed from the preceding paper. *Sesamia inferens*, Wlk., is primarily a pest of sugar-cane, but was found infesting rice crops that immediately followed cane. Where rubber replaced the sugar-cane, the moth died out, and rice subsequently planted near the rubber was free from infestation. Breeding operations were begun in July 1929 on *Trichogramma nanum*, Zehnt., which parasitises the eggs of *Diatraea auricilia*, Dudg., and *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.). The technique followed in the breeding operations is that devised by Flanders [*cf. R.A.E.*, A, xvii, 455, etc.], with slight modifications. The eggs of *Sitotroga cerealella*, Ol., the laboratory host, are fastened to cards by a solution of chromed gum tragacanth, which is easier to handle than shellac. A card holding 10,000 eggs is placed in a glass tube, into the open end of which is inserted a smaller tube containing some 2,000 parasites. The tubes are then placed in a hole in a wooden box, the tube containing the eggs being in the light and that containing the parasites in the dark. The latter are attracted to the light and oviposit in the eggs. They are kept working at night by a powerful flood light, and about 90 per cent. of the eggs are parasitised. From 1st January to 30th June 1930 an average of 25,735 parasites was despatched daily from the laboratory for subsequent release. The method of liberation is described. From the results obtained in experimental plots, the parasites appear to have checked the stem-borers at the growing period and at the early stages of the flowering and ripening of the crop. The areas to windward of the main experiment showed a considerably heavier infestation by stem-borers than did the colonised area or those to leeward of it, the parasites being distributed by the wind.

C[ORBETT] (G. H.). **Entomological Notes. Second Quarter, 1930.**—*Malayan Agric. J.*, xviii, no. 7, pp. 359–362. Kuala Lumpur, July 1930.

Notes are given on insect pests recorded in Malaya during the second quarter of 1930. The Meloid, *Epicauta ruficeps*, Ill., was very numerous on vegetables. The increase of the beetle is generally associated with grasshoppers or locusts, on the eggs of which the larvae feed, but these did not appear to be unusually numerous in the districts concerned, though *Locusta migratoria migratorioides*, Rch. & Frm., was observed elsewhere. This locust was first recorded in Malaya in 1911, but it had not been observed since 1919. Coconuts were damaged by *Oryctes rhinoceros*, L., and *Rhynchophorus schach*, Oliv. [*cf. R.A.E.*, A, xvi, 301]. Slight injury was also caused by larvae of *Parasa lepida*, Cram., which are parasitised by *Apanteles parasae*, Rohw. ; *Aleurodicus destructor*, Mackie, was noticed on two occasions. A table is given showing that weekly collections of coffee berries during May and June have reduced the percentage of infestation by *Stephanoderes* (*Cryphalus*) *hampei*, Ferr., in two areas [xviii, 509]. The caterpillars of the Notodontid, *Stauropus lichenina*, Butl., attack gutta-percha [*Palaquium*], in some cases defoliating the plants. Outbreaks of this moth appear to be sporadic, occurring at considerable intervals. The egg

stage occupies 5 days, the larval 17 and the pupal 9. No larvae hatched from eggs sprayed with a solution of 8 oz. kainit to 1 gal. water. Calcium cyanide has proved very efficacious against the Cerambycid, *Pachyteria virescens*, Pasc., boring in gutta-percha. The numbers of *Trichogramma nanum*, Zehnt., liberated for the control of rice stem-borers has been reduced to 20,000 every three days [see preceding paper] in order to allow of an increase in the supply of eggs of the host, *Sitotroga cerealella*, Ol. Several alternative food-plants of *Diatraea auricilia*, Dudg., have been recorded, including *Hymenachne myuros*, *Sacciolepis myosuroides*, *Setaria rubiginosa* and *Oryza latifolia*. An egg parasite of *Sesamia* [*inferens*, Wlk.], has been found, but it is thought to be too large to breed in *Sitotroga* eggs. *Spodoptera mauritia* Boisd., damaged rice in nurseries in June.

TAKAHASHI (S.). **Insect Pests of Fruit Trees.** [*In Japanese.*]—Vols. i & ii, 1224 pp. Tokyo, Meibundo, 1930. Price Y.7·5 per vol.

Illustrated descriptions are given of over 500 species of insects injurious to fruit trees in Japan, including 210 on pear,. 180 on apple and 130 on *Citrus*, with notes on their bionomics and control.

YAMAZAKI (Y.). **A Pest of** *Tectona grandis*, *Hyblaea puera*, **Cram.** [*In Japanese.*]—*Taiwan Sanrin Kaiho* [*Rep. Formosan For. Soc.*], no. 54, pp. 5–12. Taihoku, 1930.

A description is given of the Noctuid, *Hyblaea puera*, Cram., which occurred in great abundance in May and June 1930 in the southern half of Formosa and defoliated teak (*Tectona grandis*), though the young trees were not injured. Parasites of the larvae included *Echthromorpha notulatoria*, F., *Hemipimpla rugosa*, DeG., *Theronia zebroides*, Krieg., and *Brachymeria obscurata*, Wlk., and various birds attacked both larvae and pupae.

KABURAKI (T.) & IWASA (T.). **A preliminary Note on the minimum Intensity of Illumination inducing photic Reactivity of the Rice Borer Moth.**—*Oyo-Dobuts.-Zasshi*, ii, no. 1, pp. 1–4. Tokyo, March 1930.

Experiments in Japan with *Chilo simplex*, Butl., showed it to react to light of a very low intensity.

EGGERS (H.). **Neue** *Xyleborus*-**Arten (Col. Scolytidae) aus Indien.**—*Ind. For. Rec.*, xiv, pt. 9, pp. 177–208. Calcutta, 1930.

The author describes, from material sent to him by C. F. C. Beeson from India [see next paper], 41 new species and 3 new varieties of the genus *Xyleborus*, and erects a new genus, *Pseudoxyleborus*.

BEESON (C. F. C.). **The Biology of the Genus** *Xyleborus*, **with more new Species.**—*Ind. For. Rec.*, xiv, pt. 10, pp. 209–272, 2 pls., 8 figs. Calcutta, 1930.

Eleven new species and one new variety of the genus *Xyleborus* are described, and a key is given to the species allied to *X. andamanensis*, Bldfd., among which there has been some confusion.

In the second section of the paper, the author summarises the available biological information on Indian species of *Xyleborus*, from data accumulated during the past 15 years by extensive collection in the forests combined with breeding out from infested logs in specially devised cages in the insectary at Dehra Dun. A list is given of the species of which at least one identified food-plant is known, their distribution being recorded by forest ranges, reserves and divisions. Appended is an alphabetical index to the trees recorded as food-plants, with the species boring into each.

RAMAKRISHNA AYYAR (T. V.). **A Contribution to our Knowledge of South Indian Coccidae (Scales and Mealybugs).**—*Bull. Imp. Inst. Agric. Res. Pusa*, no. 197, v+73 pp., 31 pls., 9 figs. Calcutta, 1930.

This revised edition of an earlier bulletin on the Coccids of South India [*R.A.E.*, A, viii, 146] includes a considerable amount of supplementary information. Keys to the subfamilies and genera are given.

PAOLI (G.). **Notizie sull'arricciamento del cotone nella Somalia italiana.** [Notes on Leaf-crinkling in Cotton in Italian Somaliland.]—*Rassegna econ. Colonie*, 1930, no. 3–4, reprint 15 pp., 18 refs. Rome, 1930.

Crinkling of the leaves of cotton has been observed in various parts of Africa, but appears to occur only in the presence of the Jassid, *Empoasca facialis*, Jac., and to be due to the effect of the insect's saliva and not to the transmission of a virus capable of development after inoculation. The symptoms decrease at the end of the season, and this has usually been thought to be due to the advent of the rains ; as regards Italian Somaliland, however, the author attributes it to a Mymarid parasite, *Anagrus* [*scassellatii*, Paoli] that attacks the eggs of *E. facialis.*

The resistance of certain varieties of cotton to Jassid attack is discussed.

PAOLI (G.). **Un Mimaride nuovo della Somalia** (*Anagrus scassellatii*, **Paoli**). [A new Mymarid from Somaliland.]—*Mem. Soc. ent. ital.*, ix, pp. 228–245, 3 figs., 13 refs. Genoa, 11th October 1930.

Anagrus scassellatii, sp. n., described from Italian Somaliland, parasitises the eggs of the Jassids, *Empoasca facialis*, Jac., on cotton and castor-oil plant [*Ricinus communis*], and *E. dolichi*, Paoli (MS.), on *Dolichos* [see preceding paper].

PETTEY (F. W.). **Control of Mealybug on Pears. Spray Experiments during 1929-30.**—*Fmg. S. Afr.*, reprint no. 47, 4 pp. Pretoria, July 1930.

Spraying experiments carried on in Cape Province during 1929–30 against the mealybug [*Pseudococcus maritimus*, Ehrh.] on pears indicated that only oil sprays are effective. In districts where the

infestation on late maturing pears is severe and the summer temperature high, however, sprays of winter and summer oils with or without nicotine sulphate proved unsatisfactory, programmes that effected control being too expensive or injuring the trees. It would appear that a satisfactory spray would have to contain an oil that is light in viscosity and of fairly low refinement, the emulsion being made on the farm to lessen the expense, and that two winter applications, at an interval of about six weeks, of a spray containing about 8 per cent. actual oil would have to be applied, provided that the trees can tolerate it. In these districts, wiping the fruit might prove less expensive. In a district where the infestation on late maturing pears preceding the sprays was fairly light and the summer temperature comparatively low, various spray programmes were tried with fair success. Five applications of 0·75 per cent. medium grade summer oil plus 40 per cent. nicotine sulphate (1 : 800), or 1 per cent. with nicotine sulphate (1 : 1,600), applied as a substitute for the last five of the eight lead arsenate sprays used in the control of the codling moth [*Cydia pomonella*, L.] were effective against both pests [*cf.* *R.A.E.*, A, xviii, 102]; these sprays followed the usual winter oil spray (4 per cent. actual oil), which by itself somewhat reduced the severity of infestation by the mealybug. In a small scale test on late pears, seven applications of 2 lb. artificial cryolite and ¼ pint fish-oil in 40 gallons water appeared to be exceedingly satisfactory, the codling moth infestation being 1·8 per cent. as compared with 6·7 per cent. with lead arsenate, and less than 0·5 per cent. of the pears being lightly infested with mealybug. This test requires confirmation before reliable conclusions can be obtained and credit definitely given to the spray for the disappearance of the mealybug. On pears ripening in midsummer, the number of summer oil or oil-nicotine sprays can be reduced to 2 or 3. The first application should be made from mid-November to 1st December before any mealybugs are in the calyx of the fruit. The conditions during these experiments, however, were not typical of the most important pear-producing areas, where the summer is hotter and drier.

In the winter, all loose bark and egg clusters should be brushed off the trees on to sheets of hessian, and burnt before any spray programme is begun. To prevent the reinfestation of the trees by mealybugs from the soil, the orchard should be ploughed either before or immediately after the winter spray. In cases of severe infestation, pruning should follow the winter spraying. As mealybugs frequently collect in the hessian bands used for trapping the codling moth, these should be removed and dipped in boiling water in early autumn, and the trunks under them brushed with an emulsion of 8 per cent. actual oil. In cases of severe infestation, the bands should be kept on the trees during the winter and cleaned every two months if necessary.

Bodenheimer (F. S.). **Contribution to the Knowledge of Citrus Insects in Palestine. iii. On the Zoogeography and Ecology of Citrus Insects, particularly those of Palestine and Mediterranean Countries.**—*Hadar*, iii, no. 1, corrected reprint 19 pp. Tel-Aviv, January 1930.

Although the insects found on *Citrus* in Palestine comprise over fifty species (which are here listed according to the part of the plant they attack), the dangerous ones are relatively few in number and of

merely local importance. Most of them are widespread in the tropical and subtropical regions of the old, and to a certain extent of the new, world and are exceedingly polyphagous. The only species confined to *Citrus* are the Aphid, *Toxoptera aurantii*, Boy., and the blossom moth, *Prays citri*, Mill., and these are both minor pests, and are not native to Palestine. Of the Coccids, which are among the most important pests, *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) has hitherto been confined to the north of Palestine, *C. aurantii*, Mask., is only found in sunny parts of orange groves, and *Icerya purchasi*, Mask., and *Ceroplastes floridensis*, Comst., occur in any numbers only in entirely shaded spots. The attack on the different species of *Citrus* varies considerably; it is thought that the increase in the numbers of *Chrysomphalus aurantii* may be connected with the increasing use of chemical fertilisers.

It is probable that the presence of weeds has a great deal to do with the occurrence of some of these pests; for example, large numbers of *Pseudococcus citri*, Risso (a major pest) are frequently found in winter on the roots of *Polygonum equisetiforme*, and *Ceroplastes floridensis* and *I. purchasi* develop on the same plant above ground. During January and February the weeds growing on swampy soil in orchards are certainly a favourable breeding-ground for the Lygaeid, *Dionconotus cruentatus*, Brullé [*R.A.E.*, A, xvii, 426]. *Ceratitis capitata*, Wied. (Mediterranean fruit-fly) also finds in various other fruit trees, and particularly in the hedges of *Opuntia ficus-indica* in the coastal plain, host-fruits that are not available in the orange groves during certain seasons of the year. Climate is known to have a very great influence on the epidemiology of citrus insects, both summer and winter conditions being very unfavourable to them, and a number of beneficial insects die off under the same conditions. *Cryptolaemus montrouzieri*, Muls., was introduced but could not survive the winter [xvi, 630]. Several other beneficial insects, including several Encyrtid parasites, occur without producing much effect, and *Novius cardinalis*, Muls., is so much more affected by the heat of summer that *I. purchasi* begins its autumn development before the predator becomes active.

The most dangerous pest of *Citrus*, which does not, however, belong to the indigenous fauna of Palestine, is the locust *Schistocerca gregaria*, Forsk., which may do immense damage when present in large numbers.

Others sections of the paper deal with the more important citrus pests of the Mediterranean region, with notes on their distribution; and the relations between the distribution of the species of *Citrus* and of the Coccids that attack them in various regions of the world.

SACHTLEBEN (H.). **Krankheiten der Koniferen. A. Die tierischen Schädlinge.** [Diseases of Conifers. A. Animal Pests.]—BEISSNER-FITSCHEN, *Handb. Nadelholzkunde*, pp. 661–712, 24 figs. Berlin, 1930.

This section of a general text-book on conifers deals with the pests attacking them in Germany and neighbouring countries, nearly all of these being insects. A brief account is given of the more important pests, including particulars of the injury they cause, and in some cases notes on their bionomics and control.

von Oettingen (H.). **Die Rispengrasgallmücke, ein bisher unbekannter Schädling.** [The Meadow-grass Gall-midge, a hitherto unknown Pest.]—*3. Wanderversamml. deuts. Ent. Giessen,* pp. 112–115, 2 refs. Berlin, 1929.

A loss of 90 per cent. of the seed of *Poa pratensis*, grown for seed in 1926 near Stettin, was found to be due to attack by a gall-midge. It is stated in a footnote that this Cecidomyiid has not yet been described, but a figure was published as a supplement to an article in *Illustr. Landwirtschaftl. Ztg.*, xlvii, 1927, p. 659. The adults are on the wing for 3–4 days and lay their eggs in the buds. The larvae hatch in a few days and suck the plant juices, destroying the inflorescence. After about 25 days, they crawl into the soil, where they hibernate in cocoons, pupation taking place in the spring. The larvae require a certain amount of moisture, and frosts are necessary for the insect to complete its development. Since the adults fly only in warm, calm weather, a low temperature during flowering is favourable to the grass. The best control is early mowing of the attacked meadows and a heavy manuring with kainit immediately after cutting the seed to kill the larvae.

Braun (K.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade, für die Zeit vom 1. April 1929 bis 31. März 1930.** [Report from 1st April 1929 to 31st March 1930 of the Stade Branch of the Imperial Biological Institute for Agriculture and Forestry.]—*Altländer Ztg.*, 1930, nos. 76–107, reprint 8 pp. Jork, 1930.

The eggs of *Psylla mali*, Schm., were not injured by the severe winter of 1928–29 in the fruit-growing districts of the Lower Elbe, and serious damage was caused to apple where spraying with carbolineum was neglected. In recent years the strawberry weevil, *Anthonomus rubi*, Hbst., has caused crop losses of up to 50–70 per cent. near Hamburg and Lübeck. The young adults bore into the strawberry stems for some time after the crop has been harvested. Bee-keeping in North Hanover is economic only by reason of the presence of heather (*Calluna vulgaris*), and the Galerucid, *Lochmaea suturalis*, Thoms., destroys many flower-buds and thus reduces the honey crop. *Enarmonia* (*Grapholitha*) *woeberiana*, Schiff., and *Cossus cossus*, L., caused very severe damage to cherry in one locality. Paradichlorobenzene gave good results experimentally against cockchafer larvae, which in 1928 had caused losses estimated at about £3,500 in a forest nursery near Lübeck. *Cheimatobia brumata*, L., had an uninterrupted flight-period from 16th October to 4th December. The adults lived for 15–20 days.

Reichert (A.). **Rosenschädlinge.** [Rose Pests.]—*Die kranke Pflanze,* vii, no. 8, pp. 101–103, 1 pl. Dresden, 1930.

Tortrix (*Cacoecia*) *rosana*, L., is a common pest of roses near Leipzig. The larvae probably hatch in autumn and hibernate under fallen leaves [*cf. R.A.E.*, A, xvii, 124]. They spin the rose leaves together, the flower-bud being sometimes included. They are parasitised by the Ichneumonids, *Phytodietus segmentator*, Grav. (*Lissonota pectoralis*, Grav.) and *Pimpla maculator*, F.

BAUNACKE (—). **Eine eigenartige Knospenverderbnis an Gartennelken.** [A peculiar Injury to the Buds of Garden Carnations.]—*Die kranke Pflanze,* vii, no. 8, pp. 106–109, 1 pl. Dresden, 1930.

A Noctuid observed mining in the buds of carnations is tentatively identified as *Polia* (*Dianthoecia*) *bicruris*, Hfn. (*capsincola*, Schiff.). *P.* (*D.*) *cucubali*, Schiff., also attacks this plant in Germany, but occurs later and injures the seed-capsules.

ZATTLER (F.). **Bekämpfungsversuche gegen Erdflöhe, Wanzen und rote Spinnmilben des Hopfens im Jahre 1929.** [Experiments in combating Flea-beetles, Bugs and red spinning Mites of Hops in 1929.]—*Mitt. deuts. Hopfenbauverbandes,* 1930, no. 1, reprint 17 pp. Munich, 1930.

Tests of proprietary insecticides against flea-beetles on hops are discussed. Oil emulsion, which should be applied before the hops flower, proved effective against *Calocoris fulvomaculatus*, DeG., but if the hop poles are replaced by skeleton frames, the absence of cracks providing shelter will render measures unnecessary, and even if they are retained, scorching them in late autumn or winter gives better results than spraying, as it destroys the eggs laid in the cracks and also kills *Tetranychus telarius*, L. This mite was a serious pest in hilly districts in 1929. The discolouration of the inflorescences is only noticeable just before picking time, the crop being ruined in 1–3 days. Treatment should therefore be applied early, and if lime-sulphur is used, it should be applied well before the Bordeaux mixture used as a fungicide, as a reaction occurs between the two sprays that injures the plants and lessens the effectiveness of both.

VON TUBEUF (C.). *Diplosis pini* (**De Geer**). (**Cecidomyiden-Studien.**)—*Z. Pfl Krankh.,* xl, no. 8, pp. 375–390, 18 figs., 8 refs. Stuttgart, 1930.

The literature on *Cecidomyia* (*Diplosis*) *pini*, DeG., is reviewed, and notes are given on the author's own observations in Germany on the pupal case and its attachment to the pine needles.

SCHNAUER (W.). **Ueber den Kartoffelkäfer** (*Leptinotarsa decemlineata* **Say**). [On the Potato Beetle, *L. decemlineata.*]—*Arb. biol. Reichsanst.,* xviii, no. 2, pp. 189–199, 4 maps, 18 refs. Berlin, May 1930.

This is a concise review of the history and bionomics of *Leptinotarsa decemlineata*, Say (Colorado potato beetle). As climatic conditions in Germany and the United States do not differ greatly, it is of the utmost importance to prevent its introduction into the former country and to exterminate it if it gains a footing.

Zacher (F.) & Kunike (G.). **Beiträge zur Kenntnis der Vorratsschädlinge. 5. Beitrag. Untersuchungen über die insektizide Wirkung von Oxyden und Karbonaten.** [Contributions to the Knowledge of Pests of stored Products. 5th Contribution. Investigations on the insecticidal Action of Oxides and Carbonates.]—*Arb. biol. Reichsanst.*, xviii, no. 2, pp. 201–231, 12 refs. Berlin, May 1930.

An account is given of experiments with various dusts that have proved effective in killing pests of stored products [*R.A.E.*, A, xvii, 641, etc.] in order to determine the manner in which they act. Insects of various orders and different sizes were used for the tests. It was found that the oxides and carbonates of magnesium, manganese, zinc, etc., when in a very fine dust, are effective contact insecticides, though they are not respiratory or stomach poisons. The action was not connected with acidity or alkalinity, and the metal radicles do not appear to be responsible, as compounds of silicon (such as sea sand) are quite effective in a very fine state of division. Though it varies with the stage of development of the insect, in general it depends on its size, smaller insects being more readily affected, and on the amount of substance used, its adhesiveness, and the size of the particles. The treated insects dry up ; the loss of weight up to death, which is probably due to loss of water, can be determined quantitatively. In damp air dusting proves ineffective, its action being most marked at high temperatures and great dryness, though at a humidity of 70 per cent. it is still apparent. The loss of moisture appears to be due to the addition to the body surface of the insect produced by the dust. Carbonates and oxides of bivalent and quadrivalent elements are particularly active.

Germination and growth of wheat are not affected by dusting with the oxides and carbonates of magnesium and copper.

Hering (M.). **Ein Beitrag zur Kenntnis des Erbsenwicklers** (*Laspeyresia nigricana* **Steph.**). [A Contribution to the Knowledge of the Pea Tortricid, *Cydia nigricana*.]—*Anz. Schädlingsk.*, vi, no. 8, pp. 88–91, 4 figs. Berlin, 15th August 1930.

The characters distinguishing the adults of *Cydia* (*Laspeyresia*) *nigricana*, Steph., and *C.* (*L.*) *nebritana*, Tr., are described and figured. The latter has often been stated to have been bred from larvae infesting peas in Germany, but it is doubtful whether it really attacks them.

Bernatsky (J.). **Huhn und Käfer im Luzernefeld.** [Poultry and Beetles in Lucerne Fields.]—*NachrBl. deuts. PflSchDienst.*, x, no. 8, pp. 66–67, 1 fig. Berlin, August 1930.

Lucerne (*Medicago sativa*) is frequently attacked in Hungary by adults and larvae of *Phytodecta fornicata*, Brügg., the second crop being sometimes completely destroyed. It has been observed, however, that the fields may be kept entirely free from the beetles with the help of turkeys or fowls.

Appel (G. O.). **Ein fliegendes Laboratorium.** [A mobile Laboratory.] —*NachrBl. deuts. PflSchDienst.*, x, no. 8, pp. 67–68, 2 figs. Berlin, August 1930.

A cabin is described that can be taken apart and loaded on the sidecar of a motor-cycle, together with the necessary laboratory equipment.

Hedicke (H.). **Die Gallen der Nadelhölzer.** [Galls on Conifers.]—*Forstl. Flugblätter*, no. 22, 4 pp., 6 figs. Neudamm, n.d.

Wolff (M.) & Krausse (A.). **Lepidopteren-Biologien in Formeln.** [Life-histories of Lepidopterous Forest Pests shown by Symbols.] —*Idem*, no. 23, 4 pp.

Kolster (—). **Bekämpfung des Kiefernspanners durch Arsenbestäubung.** [Dusting with Arsenicals against *Bupalus piniarius*, L.]—*Idem*, no. 24, 7 pp.

Evenius (J.). **Was muss der Imker bei einer Arsenbestäubung tun?** [What must the Bee-keeper do when Forests are being dusted with Arsenic?]—*Idem*, no. 25, 4 pp.

The first of these German forestry leaflets gives lists of the various gall-producing insects occurring on conifers, indicating the part of the tree attacked and the type of injury caused by each. The second shows the life-histories of some forty important forest pests by means of a convenient system of symbols. The fourth is intended for bee-keepers in or near forests that are to be treated with arsenical dusts. All hives should be moved to a distance of $3\frac{1}{2}$ miles before dusting begins, or the bees should be shut in the hives. Their release or the return of the hives should be delayed until after heavy rain.

Eckstein (—). **Ein wichtig gewordener Schädling des Laubholzes: *Hylecoetus dermestoides*.** [*H. dermestoides*, a Pest of deciduous Trees that has become important.]—*Forstarch.*, v, 1929, pp. 260–261, 3 figs. (Abstract in *Neuheiten Geb. PflSch.*, 1930, no. 2, p. 44. Vienna, 1930.)

In Germany, the adults of the Lymexylonid beetle, *Hylecoetus dermestoides*, L., occur in spring or early summer and oviposit on fresh stumps or felled trunks of deciduous trees, or rarely on stumps of conifers. The larvae feed on fungi in the galleries, the spores being introduced by the ovipositing female. Timber left lying in the forest is attacked, and great loss results. All felled timber should be removed and worked without delay.

Baudyš (E.). **Der kleine Frostspanner.** [The small Winter Moth.] —*Verlautbar. deuts. Sekt. Mährisch Landeskulturrat Brünn*, no. 5, 1929, 2 pp., 1 fig. (Abstract in *Neuheiten Geb. PflSch.*, 1930, no. 2, pp. 51–52. Vienna, 1930.)

An account is given of the usual methods of controlling *Cheimatobia brumata*, L., which is the most serious pest of cherry in Moravia.

Samuel (G.), Bald (J. G.) & Pittman (H. A.). **Investigations on "Spotted Wilt" of Tomatoes.**—*Bull. Council Sci. Ind. Res.*, no. 44, 64 pp., 1 fldg. pl., 35 figs., 17 refs. Melbourne, 1930.

A detailed description is given of the distribution, severity and symptoms of spotted wilt, a virus disease of tomatos first observed near

Melbourne in the season of 1915–16. It has since been recorded from all the States of Australia, and in certain years causes very serious losses in the South. No evidence has been obtained that it is transmitted by seed or by soil, but transmission by means of sap secured by crushing diseased plants has been accomplished, although with difficulty. Insects tested as vectors with negative results were two apparently undescribed species of Jassid, Aphids (probably *Macrosiphum gei*, Koch, and *Myzus persicae*, Sulz.), *Trialeurodes vaporariorum*, Westw., *Tetranychus telarius*, L., *Phyllocoptes lycopersici*, Tryon, *Thrips tabaci*, Lind., and *Anaphothrips* (*Hemianaphothrips*) sp., but transmission was consistently obtained with *Frankliniella insularis*, Frankl., which has been found in association with all cases of the disease examined in South Australia. This thrips has also been found on tomato in New South Wales, Victoria and Western Australia and is common on many summer flowers in South Australia and New South Wales, but has never been observed near Melbourne. This seems to indicate that although it is probably the main vector in South Australia, it is not the only insect capable of transmitting spotted wilt.

Both sexes of *F. insularis* are briefly described. Studies with five individuals showed that no eggs were laid until 5 days after emergence. Reproduction is both sexual and parthenogenetic. The eggs are deposited beneath the epidermis of a leaf beside a vascular bundle, and the egg, larval and pre-pupal and pupal stages (which are passed in the soil) each occupy approximately 10 days, but vary with the temperature. The adults live about a month (over 4 months under cold conditions), and begin to feed about 6 days after emergence, sometimes remaining on a single leaf for many days and sometimes moving from plant to plant.

The experiments indicated that the thrips may inoculate a plant with spotted wilt after six hours' feeding, shorter periods not having been tested. Both adults and larvae may transmit the disease, but infective individuals fed for successive days on fresh healthy plants did not infect every plant on which they fed. The infective principle was, however, retained in the insects throughout the 24 days' duration of the experiment. If a larva has fed on a diseased plant, the adult to which it gives rise may be infective. *Datura stramonium*, tobacco and other species of *Nicotiana* have been infected by the feeding of *F. insularis*, and there are indications that other solanaceous plants may be subject to the disease. None of 48 commercial varieties of tomato tested is appreciably resistant, but a small fruited variety of no commercial value is fairly resistant, and cross-breeding experiments with it and standard varieties are being made. Unsatisfactory results have been obtained in experiments in the control of the disease by insecticide dusts and sprays or by fumigation with sodium cyanide in greenhouses.

JARRETT (P. H.). **The Rôle of *Thrips tabaci* Lindeman in the Transmission of Virus Diseases of Tomato.**—*Ann. Appl. Biol.*, xvii, no. 3, pp. 444–451, 12 refs. London, August 1930.

The part played by insects in the transmission of virus diseases of tomatos is briefly discussed, and experiments designed to determine the degree of responsibility of *Thrips tabaci*, Lind., in this connection

are described in detail. The diseases tested were tobacco mosaic, glasshouse streak and experimental streak, which was produced by a combination of either of these viruses with that of potato mosaic. No transmission of any of the viruses was secured, although the thrips fed freely on the diseased and healthy tomatos.

Hamilton (M. A.). **Notes on the Culturing of Insects for Virus Work.**—*Ann. Appl. Biol.*, xvii, no. 3, pp. 487–492, 1 pl., 3 figs., 4 refs. London, August 1930.

A method is described of keeping pure and uninfected cultures of Aphids for virus work. The cage employed is made from transparent cellulose paper (cellophane) [*R.A.E.*, A, xvii, 728] wrapped round a light metal frame. The frame consists of two galvanised iron metal bands joined by four wires and may be 14 ins. high and 7 ins. in diameter. The metal bands are smeared with a waterproof cement, which can be made by dissolving cellulose acetate in ethyl acetate, and a sheet of cellophane is quickly and not too tightly wrapped round, leaving an ample margin at top and bottom. If it is too tight, it is liable to split, as cellophane shrinks when damp. The free edges are then joined by a liberal application of cement, and a circle of bolting silk is gummed round the edges and stretched over the top by an elastic band. A tight strapping of insulating tape is applied to cover the free edges of the material and protect the cellophane where it is drawn over the sharp metal edges. The strapping must overlap to stick. At the base of the cage, the strapping should be finished so that the outer free end is above the level of the water in which the cage stands. It is advisable to cement down the outer edge, as the rubber solution tends to rot. The cages are stood in damp sand when used for Aphids and in water when used for thrips (which might pupate in the sand) in any flat receptacles such as earthenware saucers. It is unnecessary to open the cages for general observation purposes, and the cellophane lasts for about 3 months in a moist atmosphere, though renewals about every 10 weeks are advisable.

An apparatus is described for feeding Aphids on artificial media, plant extracts or dyes. It consists of a pair of cone-shaped glass capsules, which fit into one another, the wide end of the upper one being downwards and resting in a ground-in shelf in the lower one. The apices form wide necks, and the upper cone, which contains the feeding fluid, is covered beneath with "fish-skin" (swim bladder) and has a rubber stopper, which can be removed for changing or replenishing the liquid. In order to introduce the Aphids into the lower cone, which is perforated by four small holes covered with circles of muslin, the apparatus is inverted and the insects are placed on the membrane by means of a camel-hair brush through the neck of the cone. From 50 to 100 Aphids can be introduced in this way without escapes, after which the apparatus is clamped into position. The mortality of *Myzus persicae*, Sulz., cultured in this manner, varies according to the strength and nature of the fluids and the general conditions, 6–7 days being the longest period for which they have hitherto been kept alive. The fact that stain can be detected in the gut after a few hours proves that the Aphids actually feed and do not merely exist in the moist atmosphere.

Cunliffe (N.). **Studies on *Oscinella frit* Linn. Comparative Records of Oat Grain Infestation in Sweden during the Year 1927, together with a Note on Sterility or "Blindness" of Grain.**—*Ann. Appl. Biol.*, xvii, no. 3, pp. 549–553, 3 refs. London, August 1930.

The data here presented, which were obtained in Sweden in 1927 and supplement a paper already noticed [*R.A.E.*, A, xvii, 288], indicate the existence of considerable variation in the extent of infestation by *Oscinella frit*, L., in the grain of different varieties of oats sown at the same time. They also suggest that sterility or "blindness" of grain may be of a varietal character, and cannot be due to the fly to any appreciable extent.

Barnes (H. F.). **On the Resistance of Basket Willows to Button Gall Formation.**—*Ann. Appl. Biol.*, xvii, no. 3, pp. 638–640. London, August 1930.

The Cecidomyiids commonly causing damage to basket willows in Britain are *Rhabdophaga heterobia*, H.Lw., *R. terminalis*, H.Lw., and *R. saliciperda*, Duf. *R. heterobia* is the most important of the three [*R.A.E.*, A, xvii, 404], but *R. terminalis* sometimes occurs in epidemic numbers.

The results are given of a number of observations carried out in 1927 and 1928 at Long Ashton and in 1929 at Rothamsted on several varieties of basket willow and some hybrids, indicating that a definite varietal variation in susceptibility exists in regard to the attack of *R. heterobia*. Whereas one of the varieties tested showed complete immunity through three generations of the gall-midge, the remaining five were severely attacked. The shoots of some varieties, when attacked, do not always form button galls, although side branching occurs.

Laing (E. V.). **Damage to Conifer Seedlings by Larvae of the Clay Weevil, *Otiorrhynchus singularis*, L. (syn. *O. picipes*, F.; *O. squamiger*, Steph.).**—*Scot. For. J.*, xliii, pt. 2, pp. 159–160, 1 pl. Edinburgh, October 1929. [Recd. 1930.]

Larvae of *Otiorrhynchus singularis*, L., the adults of which are known to feed on the foliage of pine and gnaw the bark of trees, have recently caused extensive damage to seedlings of Scots pine [*Pinus sylvestris*] in a nursery in Scotland, the root-system being almost completely destroyed. For observation purposes, larvae were placed in glass jars in which pine seedlings had been planted, and within a fortnight the roots were completely destroyed, the larvae devouring first the finer rootlets and then the older roots. In the following spring they pupated, and in October the insects had reached maturity.

The damage is very similar to that done by cockchafer grubs; the appearance of the two kinds of larvae is compared. *O. singularis* is a common insect in gardens and hedgerows, little being known of its life-history. Soil fumigants tested for clearing the seed-beds of the grubs included carbon bisulphide, naphthalene and toluene; the first was ineffective, but the other two were completely successful.

CARROLL (J.) & TURPIN (T.). **Control of Red Mite on Apple by Winter Spraying.**—*J. Dept. Agric.* [*Ireland*], xxx, no. 1, reprint 7 pp., 1 ref. Dublin, 1930.

Further experiments in the field and laboratory were carried out with various proprietary oil sprays, a lubricating oil emulsion and a tar distillate wash (Carbokrimp) as dormant sprays against *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) on apples in Ireland [*cf.* *R.A.E.*, A, xviii, 23]. The results confirmed the previous conclusions that tar distillates are of little value in controlling the pest ; 63–67 per cent. of the eggs hatched when tar distillate at 8 per cent. strength was used in January, as compared with 18–20 per cent. with 3 per cent. Volck oil, 17–21 per cent. with 4 per cent. Sunoco oil, and 15–18 per cent. with a lubricating oil emulsion of 3 per cent. actual oil content, the last-named being applied in February. When the same strengths of Volck and Sunoco were applied as delayed dormant sprays in March, the percentage of eggs hatching was 15–18 in both cases. Oil sprays were not effective in killing the eggs of Aphids or suckers [*Psylla mali*, Schmidb.]. With a mixture of Sunoco and Carbokrimp (containing 3 per cent. of the former and 6 per cent. of the latter) only 9–10 per cent. of the eggs of *Paratetranychus* hatched, and with a mixture of the lubricating oil emulsion and the tar distillate (containing 3 per cent. of the former and 6 per cent. of the latter) 8–12 per cent. hatched. In both cases the eggs of Aphids and *Psylla* were satisfactorily controlled. Neither of these sprays will mix in their undiluted forms, but should be made up separately and then combined. The results obtained in the orchard were in close agreement with those obtained in the laboratory trials.

[SILANT'EV (I. M.).] **Силантьев (И. М.). List of Animals injurious to Flax.** [*In Russian.*]—*Plant Protection*, vi, no. 3–4, pp. 383–388, 76 refs. Leningrad, October 1929. [Recd. 1930.]

A list is given of the insect pests of flax recorded in the literature from various countries or observed by the author in 1928 in the Leningrad Government, with references to sources from which information on them may be obtained.

[STARK (V. N.).] **Старк (В. Н.). On the Formation of Bark Beetles' Associations under the Influence of the Density of Forest.** [*In Russian.*]—*Plant Protection*, vi, no. 3–4, pp. 389–398, 4 figs. Leningrad, October 1929. [Recd. 1930.]

A list is given of 79 species of Scolytids observed in the forests of the Bryansk district up to the year 1928, arranged under the types of forest in which they occur. Any change in the density of the forest is followed by a change in the associations of the bark-beetles, certain species being replaced by others or disappearing under the altered conditions, though some occur at all densities. The number of species varies directly with the age of the forest, the maximum being reached in fully mature plantations.

[Shchegolev (V. N.).] **Щеголев (В. Н.). Owlet-moths as Pests of technical Plants in the North Caucasus.** [*In Russian.*]—*Plant Protection*, vi, no. 3–4, pp. 399–406, 2 refs. Leningrad, October 1929. [Recd. 1930.]

Notes are given on the bionomics of various Noctuids that attack oil-producing, medicinal and textile plants in the North Caucasus, including : *Euxoa segetum*, Schiff., on rhubarb (*Rheum tanguticum*), ground-nuts (*Arachis hypogaea*), castor (*Ricinus communis*), *Hibiscus cannabinus*, sesame (*Sesamum indicum*), etc. ; *Feltia exclamationis*, L., on ground-nuts ; *Euxoa* (*Agrotis*) *conspicua*, Hb., on soy-beans (*Glycine hispida*) ; *Agrotis c-nigrum*, L., on belladonna (*Atropa belladonna*), fox-glove (*Digitalis purpurea*), etc. ; *Barathra brassicae*, L., on rhubarb, poppy (*Papaver somniferum*), *Melilotus officinalis*, soy-beans, flax, castor, peppermint (*Mentha piperita*), belladonna, sesame, safflower (*Carthamus tinctorius*), etc. ; *Scotogramma trifolii*, Rott., on hemp, rhubarb, soy-beans, ground-nuts, flax, castor, *Hibiscus cannabinus*, cotton, etc. ; *Polia suasa*, Schiff. (*dissimilis*, Knoch), on soy-beans, etc. ; *P. oleracea*, L., on belladonna and valerian (*Valeriana officinalis*) ; *Acronycta rumicis*, L., on rhubarb, *Melilotus officinalis*, soy-beans, ground-nuts, castor, *Hibiscus cannabinus*, cotton, sesame, etc. ; *Simyra nervosa*, Schiff., on flax and sunflowers (*Helianthus annuus*) ; *Laphygma* (*Caradrina*) *exigua*, Hb., on flax, ground-nuts and belladonna ; *Tarache* (*Acontia*) *lucida*, Hfn., on hollyhock (*Althaea rosea*) and marshmallow (*A. officinalis*) ; *Phytometra chrysitis*, L., on *Symphytum* ; *P. confusa*, Steph., on castor and *Melissa officinalis* ; *P. gamma*, L., on hemp, soy-beans, ground-nuts, peppermint, safflower, etc. ; and *Grammodes stolida*, F., on flax.

A list of the plants with the insects that attack them is appended.

[Vorontzovskiĭ (P. A.).] **Воронцовский (П. А.). Materials for the Study of the Oothecae of Acridoidea. iii.** [*In Russian.*]—*Plant Protection*, vi, no. 3–4, pp. 407–410, 6 figs., 3 refs. Leningrad, October 1929. [Recd. 1930.]

In this continued paper [*cf. R.A.E.*, A, xvii, 136] the egg-pods of *Stenobothrus fischeri*, Ev., *S. nigromaculatus*, Herr., *S. eurasius*, Zub., *Stauroderus miramae*, Ramme, and *Epacromia thalassina*, F., are described and figured.

[Pliginskiĭ (V. G.).] **Плигинский (В. Р.). Notes on the Morphology and Biology of** *Aporia crataegi* **L.** [*In Russian.*]—*Plant Protection*, vi, no. 3–4, pp. 411–416, 1 fig., 1 ref. Leningrad, October 1929. [Recd. 1930.]

Detailed descriptions are given of the egg and different larval instars of *Aporia crataegi*, L., with notes on its bionomics as observed in the Kursk Government, which are similar to those described elsewhere [*cf. R.A.E.*, A, xvii, 430]. This butterfly chiefly infests apples, but may also attack pear, plum, currant and a number of other plants, most of the eggs being laid on the lower surface of the leaves. The winter nests of the larvae contained cocoons of *Apanteles* sp.

[BRYANTZEV (B. A.).] Брянцев (Б. А.). **Methods of calculating the Profitableness of Measures for protecting Crops from Pests.** [*In Russian.*]—*Plant Protection*, vi, no. 3–4, pp. 461–488, 2 refs. Leningrad, October 1929. Also as *Mem. Agric. Inst. Leningrad*, vi, no. 4, 28 pp., 2 refs. Leningrad, 1929. [Recd. 1930.]

This is an attempt to express by means of mathematical formulae the amount of profit obtained by measures against pests, based on the cost of production and ultimate value of the crop, and the cost of labour, material, etc., for control measures.

[RUDNEV (D. F.).] Руднев (Д. Ф.). **Notes on the Biology of** *Eccoptogaster aceris* **Kn. (Ipidae).** [*In Russian.*]—*Plant Protection*, vi, no. 3–4, pp. 517–519, 5 refs. Leningrad, October 1929. [Recd. 1930.]

The distribution of *Scolytus* (*Eccoptogaster*) *aceris*, Knotek, in the steppe forests of the Kiev Government, where it is a minor pest of standing and fallen maple trees (*Acer* spp.), is briefly described. It usually attacks weakened trees and has one generation a year. In 1927, the first beetles emerged on 10th June ; oviposition lasted from the end of the month till the beginning of August. The first larvae appeared about mid-July, and pupation took place about mid-May of the following year. The mother and larval galleries are described. The pest is controlled by a number of parasites ; of these, *Dendrosoter protuberans*, Nees, which is probably the most important, in some localities destroyed 70 per cent. of the larvae.

[SOKANOVSKII (B.).] Сокановский (Б.). **Notes on Forest Pests in the Government of Vladimir.** [*In Russian.*]—*Plant Protection*, vi, no. 3–4, pp. 521–526. Leningrad, October 1929. [Recd. 1930.]

This paper deals with the principal pests of pine and spruce observed in 1927 and 1928 in the Vladimir Government, where the forests became very susceptible to infestation after serious fires that occurred in 1920–22.

The adults of *Spondylis buprestoides*, L., were on the wing in the second half of June and oviposited at the base of the trunks of burnt pines or sometimes of less severely damaged ones, especially when part of the roots was exposed. Most of the larvae occurred in the roots and up to about 20 ins. above the ground. There was one generation a year, pupation taking place in May. The infested trees should be felled and the stumps uprooted and removed at once. The goat-sucker (*Caprimulgus europaeus*) was found feeding on the adult beetles.

The mass flight of *Monochamus sutor*, L., and *M. galloprovincialis*, Ol., occurred in mid-June in 1927 and mid-May in 1928. The beetles chiefly infested recently felled pines exposed to the sun, but also attacked standing trees weakened by fires or by *Myelophilus* (*Blastophagus*) *piniperda*, L., and *M.* (*B.*) *minor*, Htg. In fallen trees the eggs were deposited in the upper part. Felled trees left in the forest should be barked, and all weakened and dying trees removed. *Monochamus quadrimaculatus*, Motsch., was abundant on logs and fallen trees of spruce in uncleared mixed stands of pine and spruce where the latter was the predominant tree. The adults were on the wing about the middle of June, their flight coinciding with that of *Sirex gigas*, L.

The larvae occurred chiefly in the butt-end of the trees and logs, mining deep into the wood. There is probably one generation a year. Barking logs and removing fallen trees is essential.

Hylobius abietis, L., is a very common pest of young pines between 5 and 10 years old, growing in uncleared areas with sandy soil. Owing to the injuries caused, the trees exude a large amount of resin and dry up. The stumps of felled trees should be barked in spring and blocks lying in shady and damp places, in which the weevil often breeds, should be removed. In a heavy infestation, the best method of control is the use of trap ditches [*R.A.E.*, A, iv, 499; xvii, 146]; 500–600 weevils may be caught weekly in each ditch. Four weevils per sq. yd. of ground indicates a serious infestation. *Pissodes harcyniae*, Hbst., was very abundant on young spruces in old and healthy stands adjacent to burnt areas, infesting 60 per cent. of trees measuring 3½ ins. in diameter from top to bottom. Oviposition probably took place at the end of July, as young larvae occurred in the beginning of August, together with fully mature ones, pupae and young adults resting in their chambers. A number of the young adults and about 70 per cent. of the pupae were killed by a fungous disease, moisture having penetrated through the bark and bast into the pupal chambers during heavy and frequent rains. *P. piniphilus*, Hbst., was abundant in some localities on pines weakened by *Myelophilus*. Oviposition was protracted, occurring chiefly in June and July. The weevils also readily infested recently felled trees with fresh bast.

Myelophilus minor and *M. piniperda* [*cf.* xvii, 145, 399] caused very serious damage. Abundant rain or extreme heat compel the larvae of the former species to penetrate into the wood deeper and sooner than usual so that 50–60 per cent. of them die. *Ips acuminatus*, Gyll. [*cf.* xvii, 399] was abundant in healthy stands of pine of middle age thinned out by felling. *I. typographus*, L., infested fallen spruce; in 1927 the mass flight occurred at the end of May. Laying out trap trees from spring till July is recommended as a control measure. *I.* (*Orthotomicus*) *starki*, Spess., infested the branches and leading shoots of fallen spruce. *Cryphalus saltuarius*, Wse., occurred in small numbers on spruce drying up owing to the plantation being too dense. It was accompanied by *Xylechinus pilosus*, Knoch, which has not been previously recorded from the Vladimir Government.

[VASINA (A. N.).] **Васина (А. Н.). A Dipteron injurious to Crops.** [*In Russian.*]—*Plant Protection*, vi, no. 3–4, pp. 531–532, 1 fig., 1 ref. Leningrad, October 1929. [Recd. 1930.]

The structure of the mouth-parts of a Dipterous larva found in the Ivanovo-Voznesensk Government (Central Russia) damaging the ears and stems of barley and the stems of wheat is described. The larvae closely resembled those of *Notonaulax trilineata*, Mg., as described by Kreĭter [*R.A.E.*, A, xvii, 142], and probably belonged to that species, adults of which were reared from barley from the same plot. The larvae were also very abundant in wild graminaceous plants, a list of which is given.

[**Investigations on Cotton Insects.**]—*7th Rep. 1928, Cotton Res. Bd. Minist. Agric. Egypt*, pp. 45–48. Cairo, 1930.

In dusting experiments in Lower Egypt in 1928, *Prodenia litura*, F. (cotton worm) was satisfactorily controlled with calcium arsenate.

Sodium fluosilicate with lime as the carrier was not so effective, probably owing to the irregular distribution on the plant of the large and heavy particles, which did not adhere well. In the case of pink bollworm [*Platyedra gossypiella*, Saund.], infestation was reduced about 20–30 per cent. by calcium arsenate and about 40–50 per cent. by sodium fluosilicate. The plants dusted with calcium arsenate were attacked by Aphids, the yield ranging from 15 per cent. below to 5 per cent. above the untreated plots according to the severity of the infestation. Plants dusted with sodium fluosilicate and lime shed their leaves and bolls prematurely, the yield being below the normal. This was probably due to some of the sodium fluosilicate in the presence of the lime and dew forming the more soluble calcium salts, which scorched the plants, for no such result was noticed when flour was used as carrier [*cf.* *R.A.E.*, A, xvii, 418]. It is hoped to make further tests with calcium arsenate mixed with nicotine dust for Aphid control, and to find some inert cheap carrier for the fluosilicate in place of lime. *P. litura* occurs every year in Egypt on the leaves of cotton and sometimes on the flower-buds and young green bolls. It is controlled by collecting the egg-masses, most of the eggs being usually laid at the end of June. It breeds on berseem [*Trifolium alexandrinum*] before attacking cotton, and to reduce its numbers the watering of the former crop is forbidden by decree after 10th May, or in the extreme North of the Delta after 31st May. Trapping experiments in the field showed the value of enforcing the law. The number of moths that successfully emerged from pupae bred at constant temperatures and humidities in the laboratory was also found to be reduced by excessive dryness. A few attacks of *Agrotis ypsilon*, Hfn., were reported from a small area of seedling cotton in the spring of 1928, and during November and December over 500 acres of wheat and berseem were seriously damaged. The activities of this moth are checked by summer conditions, but it reappears in autumn and winter. Individuals of *Microbracon kirkpatricki*, Wlkn. [xvii, 541] were released for the control of *P. gossypiella*, and there was some evidence that they became established. The work of hot air machines for treating cotton seeds, and of the special machine for treating ginnery sweepings, proved satisfactory against this pest during the season of 1928–29. A table is given showing the percentage of sound bolls from samples examined for bollworm attack every 10 days, from 1st July to 21st September inclusive.

de Peyerimhoff (P.). **Notes sur sept Coléoptères découverts récemment dans le Nord de l'Afrique.**—*Bull. Soc. ent. Fr.*, 1930, no. 16, pp. 255–260, 2 figs. Paris, 1930.

Among the species dealt with, the Curculionid, *Pissodes notatus*, F., and the Scolytid, *Pityophthorus glabratus* subsp. *mauretanicus*, n., are recorded on pines in Algeria.

Skaife (S. H.). **Insect Pests of the Hive. I. The Tachinid Parasite.**—*Bee Wld.*, xi, no. 9, pp. 106–107. Camberley, Surrey, September 1930.

Most of this information on *Rondaniooestrus apivorus*, Villen., a parasite of adult bees in South Africa, which is reprinted from *S. Afr.*

Bee J., Aug. 1926, has already been noticed [*R.A.E.*, A, ix, 442], but the larval stage is stated to last about a month and the pupal stage about 10 days. The females each deposit 300–500 larvae.

ANGELLAZ-NICOUD (—). **Une nouvelle maladie de l'abeille adulte : L'apimyiase ou maladie de la mouche.**—*Bull. Soc. Sci. vét. Lyon*, Nov.–Dec. 1929, p. 235. (Abstract in *Bull. Inst. Pasteur*, xxviii, no. 21, p. 1016. Paris, 15th November 1930.)

Parasitism of bees by the larvae of an unknown fly is recorded in France. The larva occurs in the thorax of the bee, which dies in 6 to 10 days.

JEPSON (F. P.). **Present Position in regard to the Control of Prickly-pear (*Opuntia dillenii*, Haw.) in Ceylon by the introduced Cochineal Insect *Dactylopius tomentosus*, Lamk.**—*Trop. Agriculturist*, lxxv, no. 2, pp. 63–72, 4 refs. Peradeniya, August 1930.

Details are given of the distribution of *Dactylopius opuntiae*, Ckll. (*tomentosus*, auct.) in Ceylon, since its introduction for the control of *Opuntia dillenii* [*R.A.E.*, A, xv, 100]. It has now been successfully established in various parts of the Island, and much land that was unfit for cultivation has been reclaimed. Distribution to certain centres has failed owing to the prevalent prickly-pear being *O. monacantha* and not *O. dillenii* [*cf. loc. cit.*]. Consignments of the scale have also been forwarded to and established in South India [*cf.* xvii, 692 ; xviii, 193] and Mauritius [*cf.* xvii, 100, 419]. In the latter country it is being used against *Opuntia tuna*. It is estimated that an area of about 40,000 sq. miles has been cleared by this insect in Madras.

NISHIKAWA (S.). **Studies on *Gaedia ignavus*, Nishikawa.** [*In Japanese.*]—*Jap. J. Seric.*, i, no. 3, pp. 259–263. Tokyo, 1930.

The Tachinid, *Gaedia ignavus*, Nishikawa, attacks silkworms [*Bombyx mori*, L.] and the larvae of *Arctornis chrysorrhoea*, L. (*Porthesia similis*, Fuess.) and *Acronycta major*, Brem., in Japan. It has five generations a year, adults from hibernated pupae beginning to emerge in May. The flies live for 1 or 2 weeks and are most active during the day at temperatures of 25–30° C. [77–86° F.]. They pair soon after emergence provided that the temperature is not below 16° C. [60·8° F.] and begin to oviposit 6–13 days later, the eggs being usually laid on the lower surface of mulberry leaves and hatching after being swallowed by the silkworms. One female may produce over 1,000 eggs. The larvae bore through the wall of the intestine into the body cavity and are usually found in the silk glands. They mature in 9–25 days.

HARUKAWA (C.) & KONDO (S.). **Studies on the Rush Saw-fly. III. Relation of Temperature to the Development of the Rush Saw-fly.**—*Ber. Ohara Inst. landw. Forsch.*, iv, no. 2, pp. 181–198, 6 charts, 5 refs. Kuraschiki, 1929. [Recd. 1930.]

The experiments described were made to ascertain the relation of temperature to the development of the egg and larva of *Tomostethus*

juncivorus, Rohwer, a sawfly attacking rush [*Juncus*], and the response to temperature of the strains occurring in Okayama and Hyôgo [*cf. R.A.E.*, A, xiv, 3; xvii, 564].

The following is taken from the authors' summary. The temperature at which development of the egg begins appears to be somewhat below 10° C. [50° F.]. The maximum for embryonic development seems to be slightly above 30° C. [86° F.], the optimum being about 27° C. [80·6° F.]. The minimum for growth of the larva is about 12° C. [53·6° F.] with a maximum between 27° C. and 28° C. [82·4° F.]. Growth is most rapid at about 25° C. [77° F.], but the highest percentage of larvae reaches maturity at a constant temperature of 20° C. [68° F.]. In a comparison of the Okayama and Hyôgo strains or races [*R.A.E.*, A, xvii, 564] it was found that there are differences in their physiological characters, although the two races are not separable morphologically. When the Hyôgo strain was reared at natural variable temperatures at Kuraschiki, Okayama, the death rate of its spring brood was slightly higher than that of the corresponding Okayama strain.

HARUKAWA (C.) & KONDO (S.). **Studies on the Rush Saw-fly. IV. Effect of Temperature upon the Cocoon Period of the Rush Saw-fly,** *Tomostethus juncivorus* **Rohwer.**—*Ber. Ōhara Inst. landw. Forsch.*, iv, no. 3, pp. 295–313, 3 charts, 8 refs. Kuraschiki, 1930.

Experience in rearing *Tomostethus juncivorus*, Rohwer, has shown that some mature larvae pupate and transform to adults without passing through a dormant state, whereas others become dormant after constructing a cocoon. In this paper the cocoon period is considered as a whole, the true pupal period not being determined. Temperature has a marked effect on the larva in the cocoon and on the pupa. The death rate increased with the temperature. At 27° C. [80·6° F.] little more than 50 per cent. emerged as adults; at 30° C. [86° F.] the larvae in the cocoon remained alive, but did not pupate. The duration of the cocoon stage was markedly shorter when the cocoons were used for the experiment immediately they were spun than when they were left exposed to winter conditions prior to experiment. Furthermore, the cocoon period was longer when the cocoon stage of the preceding generation had been so exposed. It is therefore thought that exposure to low temperatures induces dormancy, and that a certain time is required to break up dormancy. Low temperature in autumn seems to be one of the conditions initiating hibernation, but it is not the sole factor causing dormancy. The difference in the colouration of the adults of the spring and autumn generations [*R.A.E.*, A, xiv, 3] is determined by the temperature during the cocoon period.

HARUKAWA (C.) & KUMASHIRO (S.). **Studies on the Seed-corn Maggot,** *Hylemyia cilicrura* **Rondani, in Japan. I. On the seasonal Life-cycle and Habits of the Seed-corn Maggot.**—*Ber. Ohara Inst. landw. Forsch.*, iv, no. 3, pp. 371–382, 2 charts, 1 pl., 7 refs. Kuraschiki, 1930.

Phorbia (*Hylemyia*) *cilicrura*, Rond., seems to be fairly widely distributed in Japan, though not always abundant. Near Kuraschiki the adults were observed at all seasons except in the hottest part of the summer. Even in the cold winter a few flies are active in the warmer

part of the day. At night or on cold, cloudy days they hide in crevices in the ground. Flies may emerge even in January, but most of the overwintering larvae produce adults in March and April. The flies of the first generation that originate from the eggs laid in January appear in April so that they occur together with those of the overwintering generation. The number of days from oviposition to the emergence of the adult varies from 18–20 when the eggs are laid at the end of June to an estimated 120–125 when they are laid at the beginning of December. The pre-oviposition period is estimated at 30–40 days in early summer and 40–60 days in late autumn and winter, but may be as long as 100 days.

The larvae of *P. cilicrura* hatch from eggs laid in cracks in the soil and bore into the sprouting seeds of cultivated plants such as beans, peas, etc., causing them to decay. They also attack the cotyledons, young stems or radicles of germinating seeds and mine in the stems of seedlings. The percentage of injury in experimental field-sowings of soy beans was highest (56·2) at the end of March, with another, very much lower, peak in autumn. No injury was observed in July and August, and no adults could be found in an ordinary, dry field. It is not known in what manner the fly passes this period. Hibernation apparently occurs in all stages, but the number of individuals hibernating as pupae seems rather small. It is concluded that there are three generations a year. Some larvae transform into adults before the summer comes, while others have not reached maturity by then. In Japan the plants attacked include cucurbits, crucifers, onions, rice, beans, peas and flax. Experimentally the larvae will feed on decaying plant tissues, and complete development was obtained on cotton-seed meal spread on the soil, but did not occur in sterilised soils.

Kuijper (J.). **Het gebruik van handbestuivers bij de rupsenbestrijding in de tabak in Deli.** [The Use of Hand Dust Guns in combating Caterpillar Pests of Tobacco in Deli.]—*Vlugschr. Deli Proefst.*, no. 53, 7 pp. Medan, August 1930.

Hand dust guns have been used with good results against Lepidopterous larvae on tobacco in the field and drying sheds in Deli, Sumatra. The dust used is 5–6 per cent. lead arsenate.

Coad (B. R.). **The Entomologist in Relation to Cotton Insect Problems of Today.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 667–672. Geneva, N.Y., August 1930.

Statistics indicate that the prevailing impression of a great increase in damage from insect pests of cotton in the United States in recent years has been largely created by increased observation of insect problems. Some form of reasonably profitable control measure is now available for all major pests, but recent developments involving the simultaneous activity of several different pests in the same field have brought about such a complicated situation that standard methods are liable to fail, and special advice suited to the local problem of the moment is frequently needed. A test has recently been made of a method involving experimental co-operation with research and

extension workers in South Carolina and Oklahoma, whereby weekly field surveys of insect activity are made and used as a basis of prompt advice to farmers. The experience gained warrants the belief that some similar system could be used to advantage in many other sections of the cotton belt.

Jaynes (H. A.). **Notes on** *Paratheresia claripalpis* **van der Wulp, a Parasite of** *Diatraea saccharalis* **Fabr.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 676–680, 4 refs. Geneva, N.Y., August 1930.

Paratheresia claripalpis, Wulp, a Dexiid parasite of *Diatraea saccharalis*, F., of which *P. signifera*, Towns. [*R.A.E.*, A, xvii, 656] is stated by Aldrich to be a synonym, has been collected from August 1928 to September 1929 in Argentina and Peru, whence it has been shipped in large numbers to Louisiana. Although it normally hibernates in the larval stage within the host in Argentina, it may be found in all stages both in winter and summer. The parasites that reach the adult stage in winter emerge on warm days, but die without attacking the host unless a period of warm weather ensues of sufficient duration to allow them to mate and larviposit. The winter climate along the coast of Peru is not sufficiently severe to induce hibernation. Examination of dead hearts among young sugar-cane showed parasitism of *D. saccharalis* amounting to 2–22·72 per cent. in Argentina, including puparia present at the time of inspection and parasites developing later from borers collected. In Cartavio, Peru, the percentage in one field was 7, and the average in three other fields was 32 per cent., including only puparia actually present and borers showing signs of parasitism. Even when the percentage of parasitism was as high as 30, however, it was necessary to cut 8–10 dead hearts to obtain one parasite, the borers having in many cases been killed by other agencies or having left the plant. Observations are recorded on the varying degrees of parasitism at different stages of *D. saccharalis*, the fields examined varying considerably in the infestation of the borer and the abundance of the parasites. Several borers containing two parasites were found in fields where parasitism was high. These produced normal puparia if the host was large.

Experiments in which puparia of *P. claripalpis* were placed in an ice-box indicate that they can support cold storage at 42–50° F. for a period of at least a month and still give 50 per cent. emergence, but data on material shipped to Louisiana indicated that the longer the period of cold storage the less the emergence obtained. Observations in Peru in July, when the average mean temperature was 64·31° F., and in June, when the temperature was a little higher, indicated that the pupal period during the cooler months lasts 37–44 days.

The efficiency of *P. claripalpis* is greatly reduced by the fact that it is attacked in the puparium by secondary parasites, which, although found only on rare occasions in Tucumán, infested 14 per cent. of one lot of puparia examined in Peru. Those found in Tucumán were determined as *Spilomicrus* sp. and *Pachycrepoideus dubius*, Ashm.

The number of puparia sent from Argentina between 24th January and 18th April amounted to 7,146, and 27,754 were sent from Peru in June and July. The puparia were packed in damp sphagnum moss in small tin boxes, these being in turn packed in strong wooden

boxes and kept in cold storage throughout the journey. Shipments from Argentina arrived after 4 weeks ; those from Peru in 15 days. Nearly 46 per cent. emergence was reported from one shipment from Peru.

Spencer (H.) & Stracener (C. L.). **Recent Experiments with Soil Animals attacking Roots of Sugarcane.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 680–684, 1 pl., 2 refs. Geneva, N.Y., August 1930.

The following is taken from the authors' summary of the results secured in experiments in Louisiana supplementary to some already noticed [*R.A.E.*, A, xviii, 168]: Under controlled conditions in a sugar-cane field with cane grown in large cylinders, *Lepidocyrtus violentus*, Fols., *Onychiurus armatus*, Tull., and *Symphylella* sp., working together, caused a marked reduction in growth and final weight and a slight reduction in percentage of sucrose. Sugar-cane inoculated under similar conditions with the fungus, *Pythium*, was affected similarly and approximately to the same extent ; cane subjected to both factors showed yet poorer growth and yield.

Of the three soil animals, *L. violentus* was the most injurious, both species of Collembola being capable of adversely affecting germination by eating portions of the buds and scales ; whereas very little damage could be attributed to the Symphilid.

Douglas (W. A.). **The Velvet Bean Caterpillar as a Pest of Soy Beans in Southern Louisiana and Texas.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 684–690, 3 refs. Geneva, N.Y., August 1930.

This is a more detailed account of an attack of *Anticarsia gemmatalis*, Hb., on soy-beans [*Glycine hispida*] already noticed [*R.A.E.*, A, xviii, 221]. Although in Florida it has been recorded as attacking velvet beans [*Stizolobium*], etc., it was not observed in southern Louisiana in 1929 on any plant other than soy-beans, with the occasional exception of cotton. The eggs are deposited singly, usually on the lower surface of the leaf, and hatch in 3–5 days. The larvae feed on the leaves for about 3 weeks, after which they generally drop to the ground to pupate $\frac{1}{4}$–2 ins. beneath the soil, although a few pupate on the plants. Moths emerged during late August or early September, 6–10 days after pupation. Three distinct generations occurred in southern Louisiana in 1929. The first injury from larval feeding was observed about the middle of August, and moths from the first brood of larvae had emerged and were ready to lay eggs by the second week in September. Data of temperature and rainfall are given for both these months. All stages of *A. gemmatalis* are described. Natural enemies include several native species of birds, bullfrogs, and a number of insect predators, such as *Sphex pictipennis*, Walsh, which has been observed capturing the larvae. The only true parasite at present known is *Brachymeria ovata*, Say, which emerges from the pupa. A fungus was sometimes a valuable factor in checking outbreaks of the caterpillars. The control measures recommended have already been noticed [xviii, 221] ; soy-beans planted for hay should be cut as soon as the larvae appear.

Hinds (W. E.). **The Occurrence of *Anticarsia gemmatalis* as a Soybean Pest in Louisiana in 1929.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 711–714, 3 pls. Geneva, N.Y., August 1930.

The following is largely taken from the author's summary: *Anticarsia gemmatalis*, Hb., appeared for the first time in injurious numbers in Louisiana in August 1929, showing a decided preference for varieties of soy-bean [*Glycine*], though adjacent velvet beans [*Stizolobium*] were slightly attacked in one instance. The only wild food-plant observed was *Robinia pseudacacia*. The infestation appeared earliest in the vicinity of Jeanerette, Louisiana, and gradually spread northward to the middle of the State. Brief notes on the life-history, habits and natural enemies are given. Late in August a general development of a fungus attacking the larvae checked the further multiplication of the moth in an important degree. Control was found possible with calcium arsenate containing 5 per cent. hydrated lime and dusted on the dry foliage, which did not cause serious injury to the plants [*cf. R.A.E.*, A, xviii, 222]. Sodium silicofluoride of the light dust type, without hydrated lime, gave good control of the larvae with very little scorching when applied to dry foliage. Treated plants put out new growth, whereas untreated ones were completely destroyed and seed setting was prevented by the larvae.

Moznette (G. F.). **Relative Effects of Bordeaux Mixture and of hydrated Lime on arsenical Sprays in the Control of the Pecan Leaf Case-bearer.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 691–699, 6 refs. Geneva, N.Y., August 1930.

Experiments were carried out in 1929 to determine the relative effects of various combination sprays in regard to foliage injury and insecticidal efficiency when used under field conditions in the control of *Acrobasis palliolella*, Rag., on pecan. Acid lead arsenate and calcium arsenate were used at the rate of 1 lb. to 50 U.S. gals. of spray, and Paris green at the rate of $\frac{1}{2}$ lb. to 50 U.S. gals.

The following is taken from the author's summary of the results obtained: Acid lead arsenate, when combined with hydrated lime or fish-oil, caused arsenical injury to pecan foliage and partial defoliation; when used with Bordeaux mixture, however, only slight foliage injury resulted with a $\frac{3}{4}$–1 $\frac{1}{4}$–50 mixture and none with the Bordeaux mixture at double this strength. Acid lead arsenate, commercial calcium arsenate and Paris green when combined with 3–5–50 Bordeaux did not cause any foliage injury. Bordeaux mixture is a much better corrective for arsenical injury to pecan foliage than hydrated lime used at the same strength. No material advantage is gained in incorporating fish-oil or calcium caseinate in combinations of Bordeaux mixture and arsenicals, as the former, being colloidal in character, is a very good spreader and sticker for the latter.

A comparison of the percentages of hibernacula of *A. palliolella* formed on the buds of pecan trees sprayed with commercial calcium arsenate or Paris green combined with Bordeaux mixture with the percentages formed on trees in the untreated plots indicates clearly that the Bordeaux mixture did not inhibit the action of the arsenicals to any appreciable degree. The results secured with acid lead arsenate in combination with Bordeaux mixture are not so significant and indicate the probability that chemical changes occurred in the com-

bination that influenced the results. Commercial calcium arsenate in Bordeaux mixture, when the arsenical was used on the same poundage basis as acid lead arsenate, was considerably more effective against *A. palliolella*. Paris green, when used at a strength at which it contained approximately the same quantity of metallic arsenic as did the acid lead arsenate used in Bordeaux mixture, was more effective than the latter, and slightly more effective than commercial calcium arsenate used at a strength at which it contained more metallic arsenic.

Commercial calcium arsenate may be used at the same poundage as acid lead arsenate in Bordeaux mixture with greater effectiveness in the control of *A. palliolella* and with a saving in the cost of the arsenical of about one-half.

SNAPP (O. I.). **Results of spraying and dusting Experiments on large Blocks of Peach Trees for the Control of the Curculio.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 699–704. Geneva, N.Y., August 1930.

The results of experiments carried out in Georgia in 1929 in a peach orchard heavily infested with *Conotrachelus nenuphar*, Hbst., indicate that lead arsenate is more effective as a spray than as a dust. Four applications were made : when the petals were falling, when the calyces were being shed, after the calyces were shed, and 4 weeks before harvest. The spray used consisted of 1 lb. powdered lead arsenate to 50 U.S. gals. water, with the addition of milk of lime made from 4 lb. hydrated lime. The applications of dust consisted of 5 per cent. lead arsenate in each case, to 95 per cent. hydrated lime in the first two and to 80 per cent. sulphur and 15 per cent. hydrated lime in the last two treatments. The petal-fall spray, applied when 50–75 per cent. of the petals had fallen, was shown to be an important part of the schedule. The dusted block had 30·2 per cent. more infested fruit than the sprayed block, and a sprayed block on which the first application was omitted had 30 per cent. more infested fruit. The dusted block had 184·6 per cent. more rotten fruit than the block that received the spray, 11·3 per cent. of the infection being at curculio punctures ; and there was 91·5 per cent. more rotten fruit in the block where the first spray was omitted, 8·1 per cent. of the infection being at curculio punctures. Of the rotten fruit in the block receiving all 4 sprays, only 3·4 per cent. was infected at curculio punctures.

EDDY (C. O.) & CLARKE (W. H.). **The Onion Thrips on Seedling Cotton, with a Season's Record of parthenogenetic Development.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 704–708, 1 pl., 1 fig. Geneva, N.Y., August 1930.

Experiments carried out in South Carolina in 1929 to determine the type of injury caused by *Thrips tabaci*, Lind., to seedling cotton showed that the growth of infested plants was retarded and malformed. In rare cases buds were blasted or lateral growth was started from the buds in the axils of the cotyledons. Unfolding leaves had holes, marginal erosions, raised thin areas and a crinkly surface.

In further studies data were collected on the life-history of *T. tabaci* during 5 generations of parthenogenetic development from 26th May to 25th September 1929. The average female lived 14 days and laid 14 eggs in a period of 8 days. Individuals developed in

14 days, nearly 5 days being spent in the egg, 2–3 in each of the two larval instars, $1\frac{1}{2}$ in the pre-pupal and 3 in the pupal stage. In July the generations followed each other within as short an interval as 15 days, the period lengthening to 26 days in August.

Osterberger (B. A.). *Erax interruptus* **Macq. as a Predator.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 709–711, 1 pl., 6 refs. Geneva, N.Y., August 1930.

Examination of freshly ploughed soil in fields of sugar-cane and other crops in Louisiana in the autumn and winter of 1928 and 1929 revealed the presence of a number of larvae of the Asilid, *Erax interruptus*, Macq. Laboratory experiments indicated that these larvae fed very readily on white grubs. They hibernated in the soil and pupated in May, the adults emerging 20–26 days later. The pupa and adult are briefly described.

In view of the predacious habits of the larva and its wide distribution and abundance, *E. interruptus* may be considered of economic importance in areas where sugar-cane is grown.

Hull (F. M.). **Some Methods of trapping Plant Lice.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 715–717, 1 pl., 2 graphs. Geneva, N.Y., August 1930.

Comparative tests of a number of flat cloth screens of various materials for the trapping of Aphids attacking vegetable crops indicated that the number of Aphids registered was roughly inversely proportional to the tightness of the weave, as, if the wind veers round the screen, they are not carried on to it. Cheese-cloth, although flimsy and not durable, was 50 per cent. more efficient than voile cloth as regards the numbers of Aphids settling on it, but the adhesive used closed the meshes of these materials. A screen of wire cloth, of a mesh not greater than 8 to the inch, coated with adhesive and pivoted with a vane to keep it square to the wind, proved the most satisfactory material. The adhesive was thinned by heating before being applied to avoid closing the meshes. Records taken by this method in 1929 in Texas indicate that the production of winged forms is particularly high in late March and early April, and reaches another high period in autumn. There are also periods when winged forms are practically absent. In December 1929, adhesive screens registered 1–2 Aphids to 4 sq. ft. of screen a week, as compared with several hundred a day in late spring. By planting crops at periods when screen records show an atmosphere clear of winged forms, several weeks growth is ensured in freedom from what is practically the only potential source of infestation.

Burgess (A. F.). **Results secured on the Gipsy Moth Extermination Project in New Jersey.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 718–720, 2 maps. Geneva, N.Y., August 1930.

Intensive work in the control of the gipsy moth [*Porthetria dispar*, L.] carried out in New Jersey over a period of 9 years is briefly reviewed. Whereas in 1920, over 3,000,000 egg clusters of *P. dispar* were treated and thousands of acres of tree growth were subsequently sprayed, in

1929, only one small colony with less than 100 egg clusters was found and spraying activities were limited to the site and surroundings of this colony. These results were accomplished by intensive scouting and cleaning up in the severely infested area until the moth become extremely scarce, followed by scouting a belt averaging more than 10 miles wide surrounding all towns where any infestation had previously been found. In the succeeding years, towns farthest removed from the central infestation were intensively scouted, so that the territory under treatment was gradually closed up to the centre, 137 sq. miles remaining to be intensively scouted at the end of the fiscal year 1929. The entire area in New Jersey that has been worked is 2,369 sq. m., exclusive of 9 isolated colonies that were exterminated within a year or two following their discovery.

According to the original estimate, the infested area was 100 sq. m., the time required for extermination 5 years and the cost £200,000. The area actually infested proved to be over 400 sq. m., the time spent hitherto being 9 years and the total amount of expenditure up to 30th June 1929, £422,500. The largest annual expenditure (in 1923) was £59,000, and the estimated expenditures for 1930 and 1931 are £25,000 and £16,000 respectively. If the estimated area infested is compared with that actually found, the expenditure on this project has therefore been much less than would be expected. The cost of operation is decreasing each year, and the work should be successfully concluded within a reasonable time.

BURGESS (A. F.). **Gipsy Moth Barrier Zone Maintenance Problem.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 720–725, 1 map. Geneva, N.Y., August 1930.

An account is given of the barrier zone maintained against the gipsy moth [*Porthetria dispar*, L.] along the Hudson River since 1923 [*R.A.E.*, A, xi, 301] for the prevention of its spread throughout New York State and to the States to the South and West. A survey made in 1924 and 1925 showed 50 infested areas well distributed throughout the zone, all of which were exterminated within the next 3 years. During 1927, only 21 infested points were found in the entire zone, which was the smallest number since the work began. The acreage of defoliation east of the barrier zone has increased steadily from 825 acres in 1924 to 551,133 acres in 1929, which implies a corresponding increase in the possibility of infestation within the zone. The number of infested localities within the zone has increased each year since 1927, and for the year ending 30th June 1929, 101 points of infestation were found and treated, the greatest number being in south-western Massachusetts and north-western Connecticut, and in the adjoining territory in New York State. Since 1st July 1929, particular attention has been paid to scouting all woodland areas in this section that have not been recently examined. By 20th November 1929, when about 25 per cent. of the proposed scouting work for the fiscal year had been completed, 56 infested localities had been found ; it is not yet known whether a corresponding increase is to be expected as the work progresses. Control measures employed are either treating the eggs with creosote or spraying against the larvae or a combination of both, the application of tree banding material to keep the larvae from reaching the tops of the trees being sometimes advisable as an auxiliary.

Continued reinfestation from the east is rendering the maintenance of the zone increasingly difficult, and it may necessitate a replacement of the barrier in more difficult territory [*R.A.E.*, A, xvii, 554]. In connection with the zone work, the pressing need for scouting a section directly east of the barrier south of the Canadian boundary in Vermont and the territory contiguous to the quarantine line in northern New Hampshire and Maine is emphasised. This would make possible the alteration of the quarantine line based on the findings, safeguard the transport of products proceeding from towns that may now be infested and facilitate the release from the quarantined areas of towns that are not infested.

Nuttycombe (J. W.). **Oviposition of the Corn Earworm Moth in Relation to Nectar Flow of some flowering Plants.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 725–728, 1 fldg. diag. Geneva, N.Y., August 1930.

In an effort to determine the importance of the food factor in relation to the number of eggs deposited by *Heliothis obsoleta*, F., during a given period, studies were made in 1927 and 1928 in Virginia of a number of nectar-producing plants. It was found that the moths fed on nectar from a great variety of these plants, the overlapping flowering periods of which cover the whole period during which oviposition occurs. As, however, nectar flow from these plants, although greatly curtailed by drought, is apparently never so reduced as greatly to affect oviposition, this factor cannot be considered the cause of marked disturbances in the normal seasonal abundance of the eggs.

Yothers (M. A.). **Second Report on some of the more important Insects captured in Codling Moth Trap Baits, Yakima, Wash., 1927-28.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 729–735, 1 ref. Geneva, N.Y., August 1930.

Observations on the earliest and latest appearances and times of maximum numbers are presented for *Hypsopygia costalis*, F., *Tortrix* (*Archips*) *rosaceana*, Harr., *Chrysopa* spp., and Noctuids captured in experiments, continued in 1927 and 1928, with bait traps for *Cydia* (*Carpocapsa*) *pomonella*, L., in Washington [*R.A.E.*, A, xviii, 68]. Records for the years 1926–28, including those given in the first report, are summarised in a table. All the insects appeared somewhat later in 1927 and 1928, as the spring was abnormally early in 1926.

Pack (H. J.). **The "Spitting" Habit of Lepidopterous Larvae.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 736–738, 5 refs. Geneva, N.Y., August 1930.

Studies in Utah in 1929 indicate that certain Lepidopterous larvae, including *Zophodia grossulariae*, Riley (gooseberry fruit-worm), *Anarsia lineatella*, Zell. (peach twig borer) and *Eucosma* (*Spilonota*) *ocellana*, Schiff., and *Recurvaria nanella*, Schiff., when they begin to eat into the surface of the leaf, invariably reject the first mouthfuls of food, a habit already noticed by other authors in respect of *Cydia* (*Carpocapsa*) *pomonella*, L., and *C.* (*Laspeyresia*) *molesta*, Busck. The following

insects were observed not to reject food : *Hulstea undulatella,* Clem. (sugar-beet crown borer), *Phytometra* (*Autographa*) *californica,* Speyer (alfalfa semi-looper) and *Loxostege* sp., all of which differ from the first group in being external feeders. The economic importance of this characteristic is apparent when an insecticide is used as a stomach poison. Quantitative tests to determine the amount of poison ingested even though most of the food is expelled should result in considerable progress in the problem of control.

CUTRIGHT (C. R.). **Additional Notes on *Aphis pomi* DeG.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 738–741, 6 refs. Geneva, N.Y., August 1930.

The results of experiments carried out in Ohio in 1929 to determine the reaction of *Aphis pomi,* DeG., when migrating in search of fresh food, to actively growing plants indicate that growing terminals of apple are at least four times as attractive as those that have completed their growth, and Aphids on them produced almost six times as many young. In the field, luxuriantly growing terminals are frequently noted with an Aphid population of 2,000–4,000, adjacent terminals of less vigorous growth harbouring only a few hundred. There is little doubt that these populations came from about the same original numbers, the difference in final population being due to difference in food. Aphid colonies observed on terminals that hardened about mid-July maintained themselves almost intact until early September without reproducing and apparently without growth. It is suggested that such individuals, if provided with suitable food, would grow and reproduce, and may be considered a potential source of infestation of winter shoots in late August and September.

FLUKE (C. L.). **The Influence of resistant Apple Scions on the Susceptibility of non-resistant Stocks with Relation to Woolly Aphid Attacks.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 741–743, 1 fig. Geneva, N.Y., August 1930.

The tests described show clearly that the use of a resistant apple scion such as Northern Spy does not affect the susceptibility of the root stock to attack by woolly aphis [*Eriosoma lanigerum,* Hausm.], and indicate that no resistance to *E. lanigerum* would be produced by the use of a resistant variety as an intermediate scion either in the scion above it or in the root below.

GAHM (O. E.). **The Mite, *Linopodes antennaepes* Banks, as a Pest of cultivated Mushrooms, with preliminary Tests toward Control.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 744–747, 1 pl. Geneva, N.Y., August 1930. Also in *J. Washington Acad. Sci.*, xx, no. 8, pp. 155–156. Washington, D.C., 1930.

Linopodes antennaepes, Banks, a mite not hitherto recorded as a pest of mushrooms, was first found attacking cultivated mushrooms in Pennsylvania during March 1929, and was later observed causing commercial damage in mushroom houses in Illinois and Minnesota. The injury produced by this mite is characterised by a partial destruction of the root system and a decided constriction of the sporophore

at the base. Reduction in crop, amounting in one case to 40 per cent. or ¾ lb. to the square foot, results from the injury caused, as attacked mushrooms fail to attain marketable size. Observations indicate that the stalk is the chief object of attack after the mushroom appears above the surface of the bed. The rapid movement of the mite increases the range of injury. Surface steaming of the compost heap, as practised against *Tyroglyphus lintneri*, Osb., was found to be a satisfactory method of control. Thermal death-point experiments showed that *L. antennaepes* will succumb to a 30 minute exposure to a temperature of 100·4° F. in a constant temperature chamber with accompanying relative humidity of 89 per cent. As the temperature below a depth of 4 inches in a manure heap is too high for the survival of the mite, it is unnecessary to penetrate the compost below that depth.

HARTZELL (F. Z.). **The Latin Square Arrangement of Experimental Plats.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 747–753, 2 refs. Geneva, N.Y., August 1930.

The following is taken from the author's abstract : Variation in infestation vitiates conclusions drawn from field tests unless the plot technique is able to compensate for it. The Latin square (chess board) arrangement of test plots has a number of advantages over the ordinary method of using strips across the area. This arrangement is applicable to areas in which the variation from plot to plot occurs by approximately constant differences. It does not always compensate for differences that occur by chance or in approximately geometrical series. Careful studies of proposed test areas should be made to determine the type of variation present, and no tests made except in places in which a high degree of accuracy can be secured.

RICHARDSON (H. H.). **Petroleum Oil Summer Sprays for Pine Leaf Scale Control (Family Coccidae—Order Homoptera).**—*J. Econ. Ent.*, xxiii, no. 4, pp. 753–758, 5 refs. Geneva, N.Y., August 1930.

The following is largely taken from the author's abstract : Lubricating oil, miscible oil, and three grades of highly refined white oil were tested in the field during the summer of 1928 for their toxicity to *Chionaspis pinifoliae*, Fitch, on white and red pine [*Pinus strobus* and *P. resinosa*]. The tolerance of the foliage of various conifers to these oils was also determined. Little difference was noticed in the toxicity of the oils to the scale when compared at strengths sufficient for control. An oil concentration of 2·5 per cent. was sufficient to give commercial control (90–100 per cent.). Highly refined white oils (Bé. 36·6°–35·4°, Saybolt viscosity 45–85 sec./100° F.) were the only oils that could be applied at a concentration sufficient for control without subsequent injury to foliage. The conifers tested varied in their susceptibility to oil spray injury in the following order : White spruce [*Picea canadensis*] (most susceptible), white pine, and red pine and Scots pine [*Pinus sylvestris*] (least susceptible). The bloom normally present on conifers disappears when an oil spray is applied, but reappears within 5–10 weeks, depending on weather conditions and the volatility of the oil.

Dearborn (F. E.). **Physical and chemical Properties of commercial arsenical Insecticides II. Magnesium Arsenate.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 758–764, 25 refs. Geneva, N.Y., August 1930.

The following is the author's abstract : Commercial magnesium arsenate insecticides are prepared by treating magnesium hydroxide suspended in water, or a solution of magnesium salt, with arsenic acid or an alkali arsenate. The di- or trimagnesium arsenate is formed, depending upon the proportion present of the reacting compounds. The reaction products are then heated in an autoclave to a temperature of 165–175° C. under pressure for several hours in order to reduce the water-soluble arsenic content to a low value. The product is then filtered, dried and ground to fine powder.

There are two grades of this product on the market, and a typical chemical and physical analysis is given of each. They both contain a crystalline material of which certain of the optical properties agree with those of the basic arsenate $Mg_3(AsO_4)_2.MgO.YH_2O$ mentioned in the patents. A short review of the published entomological tests with this material is included.

Mundinger (F. G.). **Studies in Apple Maggot Control in the Hudson Valley.**—*J. Econ. Ent.*, xxiii, no. 4, pp. 764–769, 1 fig. Geneva, N.Y., August 1930.

The timing of applications for protecting apples against *Rhagoletis* (*Trypeta*) *pomonella*, Walsh, which hibernates in the soil in the pupal stage, is best determined by the use of large emergence cages [*R.A.E.*, A, xv, 424] under nearly natural conditions. Data of emergence obtained by this method in the Hudson Valley, New York, during the years 1926–29 indicate that the period of maximum emergence varies somewhat in duration and time of occurrence from year to year. The yields of the cages differed considerably, some producing few flies and others as many as 44 a day. Periods of maximum emergence consistently followed the first series of warm days after 1st July, and greatly reduced emergences followed dry months in 1927 and 1929. More flies were obtained from cages placed over uncultivated areas than from cages placed over areas where the soil had been disturbed. In 1927 only 15 flies were taken from 15 cages left on the original sites for two consecutive seasons, indicating that the great majority of flies have a life-cycle of one year in this area. The probability of the occurrence of more than one brood in one season appears very slight. As the flies feed for a considerable time before ovipositing, it is inadvisable to begin protective measures until the number appearing in the cages indicates that maximum emergence has been almost reached.

Experiments in the control of *R. pomonella* with various sprays and dusts containing lead arsenate at the rate of 2½ lb. to 100 U.S. gals. and 10 : 90 respectively in the years 1926, 1927 and 1929 indicate that a large measure of protection can be secured by one application of spray as the flies are beginning to increase in numbers in the cages and another about 10 days later. Under dry conditions dust may be used in place of the second spray, or in dry seasons dust may be used altogether. Early varieties of apple, which showed on the whole

a somewhat earlier maximum emergence period of *R. pomonella*, should be carefully observed and receive first treatment. It has been demonstrated that success in one season is no guarantee of future freedom from attack, and two applications should be made even where emergence appears slight in cases where *R. pomonella* has been known to occur in dangerous numbers.

FLETCHER (R. K.). **Note on *Plebeius acmon* Doubleday and Hewitson.**—*J. Econ. Ent.*, xxiii, no. 4, p. 770. Geneva, N.Y., August 1930.

Lepidopterous larvae found infesting pods of *Astragalus trifloris* near Marfa, Texas, in April 1930, when transferred to the pods of English peas and bred out in the laboratory, were identified as *Plebeius acmon*, Dbldy. & Hew. They did not readily feed on the peas. *Astragalus trifloris* is believed locally to be poisonous to livestock. About 80 per cent. of the pods of the plants examined were infested by the larvae.

POOS (F. W.). **A new Method of distributing *Empoasca fabae* (Harris).**—*J. Econ. Ent.*, xxiii, no. 4, p. 770. Geneva, N.Y., August 1930.

Green beans brought to Washington from Florida early in 1930 were found to be infested with *Empoasca fabae*, Harr., as many as 7 individuals hatching from a single pod. This is apparently the first record of oviposition by this species on the pods of green beans under field conditions. Beans received on 14th March that had been kept in individual lots at different temperatures between 21 and 29° C. [69·8 and 84·2° F.] showed little difference in time and amount of hatching when kept at room temperatures in the laboratory after removal from storage on 21st March. Observations of a second series of 4 lots of material kept at temperatures between 4·5 and 15° C. [40·1 and 59° F.] for a week preceding 28th March and subsequently at room temperature showed that hatching continued until 17th April in the case of the lot that had been kept at 15° C. [59° F.], whereas less hatching apparently occurred in the lots that had been kept at the lower temperatures.

OSBURN (M. R.). **Fumigation of fresh Fruit with Carbon Disulphide for the Destruction of Adult Japanese Beetles.**—*Circ. New Jersey Dept. Agric.*, no. 188, 20 pp., 7 figs., 4 charts, 4 refs. Trenton, N.J., June 1930.

The inspection of small fruits intended for shipment from an area infested with the Japanese beetle [*Popillia japonica*, Newm.] is impracticable, since the fruit is likely to become injured by excessive handling and the presence of the beetle cannot always be detected. Experiments are described in which a number of fumigants were tested for the purpose of destroying the beetles infesting fruit already packed in crates for transportation. The results indicate that carbon bisulphide, at the rate of 10 lb. to 1,000 cu. ft., was the most effective in destroying the beetles when the treatment was prolonged for two hours at a temperature of 80° F., and was in no way injurious to the

fruit. Higher temperatures should be avoided in view of their detrimental effect on the fruit. The fumigant should be volatilised rapidly, in order that the full concentration may be obtained in about 15 minutes. The properties of carbon bisulphide are given; if it is impure, a slight residue may be left after evaporation of the liquid. The construction of the fumigating houses is described in detail; as many crates or boxes of fruit as the fumigating chamber will hold can be fumigated at a time, but when they are stacked one on another, narrow strips of wood are placed to separate them, thus providing for better and more rapid penetration of the gas.

Knight (Hugh), Chamberlin (J. C.) & Samuels (C. D.). **On some limiting Factors in the Use of saturated Petroleum Oils as Insecticides.**—*Plant Physiology*, iv, pp. 299–321, 2 figs., 6 refs. Chicago, Ill., 1929. [Recd. 1930.]

During investigations into the insecticidal efficiency of saturated petroleum oils [*R.A.E.*, A, xv, 596], some adverse physiological effects occurred on *Citrus*. A study of the disturbances created in the metabolism of the plant was therefore undertaken, and the experiments are described and discussed.

The disturbances appear to be due to the physical effect of the penetration of the oil into the plant tissue rather than to any chemical reaction. The persistence of the oil film depends primarily on the morphology of the leaf and the viscosity of the oil, and varied from a few minutes to 15–20 days. The disappearance of the oil is due to absorption by the leaf, the amount lost by volatilisation being negligible except in the case of non-lubricating oils. Penetration is most rapid in areas rich in stomata, but may occur by seepage between the epidermal cells of the upper (stomata-free) surface of the leaf. Beginning within a few days after entrance into the intercellular spaces of *Citrus* and extending over many months in the case of a saturated petroleum oil of 106 seconds viscosity, the oil is taken into the vascular system of the plant and passes to the storage tissues (pith and xylem parenchyma). No oil has been observed in the xylem of the current year's growth. During the period of oil penetration and initial transference, transpiration is sharply decreased and respiration greatly increased. Photosynthesis becomes temporarily inoperative. Recovery begins most rapidly in the case of light oils and is indicated by the return of transpiration and respiration rates towards normal and by the accumulation of carbohydrates in the leaves in abnormally large amounts. The latter phenomenon is correlated with the fact that the conducting vessels (phloem primarily) are still taxed to capacity with oil and so cannot deal with the carbohydrates produced in excess of the needs of the leaves. Thus this increase in carbohydrates is not an indication of stimulated growth as has been believed. It was also found that a plant is capable of transporting oils upwards from the roots to the leaves, and the intracellular absorption of oils from the intercellular spaces of the leaf and from the soil indicates the passage of oil molecules through the cell membrane into the cytoplasm of the cell. It is concluded that heavy white oils of a viscosity exceeding 60 seconds Saybolt must be used sparingly and cautiously if serious ultimate injury is to be avoided.

ROARK (R. C.) & COTTON (R. T.). **Tests of various Aliphatic Compounds as Fumigants.**—*Tech. Bull. U.S. Dept. Agric.*, no. 162, 52 pp., 7 refs. Washington, D.C., March [1930].

Though a mixture of 40 parts by volume of ethyl acetate with 60 of carbon tetrachloride [*R.A.E.*, A, xiii, 51, 178] is safe from fire hazard at fumigating temperatures, that is, up to 90° F., in order to make the ethyl acetate nonflammable at temperatures up to 122° F. (the temperature at which the underwriters' laboratories conduct tests), it is necessary to add carbon tetrachloride to the extent of 70 per cent. of the mixture. The toxicity of this mixture was not satisfactory. Moreover, wheat fumigated with ethyl acetate may have a sour odour resulting from acetic acid formed by hydrolysis of ethyl acetate. Further experiments were therefore undertaken with 309 aliphatic compounds in an attempt to find a more satisfactory fumigant for insects infesting grain, foodstuffs, clothing, carpets, and furniture. The tests were made on *Calandra* (*Sitophilus*) *oryzae*, L. (rice weevil) in flasks half filled with wheat. Many of the effective compounds are unavailable commercially, others are too expensive, and others are injurious to the germination of the wheat. Seventeen compounds showing promise of commercial value were tested in a 500 cu. ft. fumigation vault. Of these, ethylene oxide and methyl monochloracetate were slightly more toxic than carbon bisulphide (they were lethal at 1 lb. per 1,000 cu. ft.) and the ethyl monochloracetate and isopropyl monochloracetate were only slightly less toxic. Ethylene bichloride mixed with carbon tetrachloride in the proportion of 3 parts to 1 by volume was lethal at a dosage of 6 lb. per 1,000 cu. ft. The low cost and effectiveness of this material and its lack of fire hazard and of toxicity to man should render it a useful fumigant.

JONES (H. A.) & SMITH (C. M.). **The Solubility of Rotenone. I. Solubility and optical Rotation in certain organic Solvents at 20°.** —*J. Amer. Chem. Soc.*, lii, pp. 2554–2562, 14 refs. Easton, Pa., 6th June 1930.

An investigation has been undertaken with a view to finding solvents of rotenone suitable for extraction and for the preparation of spray mixtures. In this paper the solubility of rotenone in 21 organic solvents at 20° [C.] is discussed, the method used for determining this property being based on the optical activity of the compound.

In general it appears that rotenone is most soluble in chloroform and ethylene bichloride, and moderately soluble in other chloro-products with the exception of carbon tetrachloride. Benzene is also a good solvent ; the addition of aliphatic residues such as in toluene and xylene seems to lower the solvent power, whereas the addition of chlorine as in chlorobenzene increases the solubility. Acetone, acetic acid, and the three esters tested (amyl acetate, ethyl acetate and *n*-propyl formate) were fairly good solvents. The alcohols and ether, contrary to statements in the literature, proved of little value, but at higher temperatures their solvent power may increase considerably.

An attempt was also made to determine the solubility of rotenone in certain oils by the same method, but, owing to the extremely low solubility in some cases and to difficulties caused by the high optical

rotation of the solvent in others, the method was not applicable. Trial experiments indicated, however, that its solubility in petroleum ether, petrol, kerosene, "Nujol" and rectified oil of turpentine is less than 0·1 per cent. at 20°. On the other hand, it appears to be appreciably soluble in Menhaden fish-oil and in steam-distilled pine oil.

Clark (E. P.). **Toxicarol. A Constituent of the South American Fish Poison** *Cracca (Tephrosia) toxicaria.*—*J. Amer. Chem. Soc.*, lii, pp. 2461–2464. Easton, Pa., 6th June 1930.

In connection with a survey of fish-poisoning plants as sources of insecticides, a chemical examination was made of the roots of *Tephrosia toxicaria* (in a footnote the author states that the correct name for the genus *Tephrosia* is *Cracca*). Two active fish poisons were isolated, a monohydroxy dimethoxy compound, toxicarol ($C_{23}H_{22}O_7$), and a dimethoxy compound, having the molecular formula $C_{23}H_{22}O_6$, both of which apparently occur in derris and the latter also in "cube" roots [*cf. R.A.E.*, A, xviii, 376].

Franssen (C. J. H.). **Das Konservieren kleiner Raupen.** [The Preservation of small Caterpillars.]—*Natuurhist. Maandbl.*, xix, no. 8, p. 93. Maastricht, 29th August 1930.

Small caterpillars kept in a mixture of equal parts of 95 per cent. alcohol and 75 per cent. lactic acid, into which they were placed alive, retained their shape and colour, even when green, during a year's observation.

Mellor (J. E. M.). **An Ant-proof Shelf for Use in either Laboratory, Kitchen, or Larder, in Countries where Ants are a Nuisance.**—*Bull. Soc. roy. ent. Egypte*, xiv, fasc. 1, pp. 36–37, 1 fig. Cairo, 1930.

The shelf described does not touch the wall but rests on metal supports that pass through receptacles containing a fresh insecticide or deterrent and are screwed on to an ordinary shelf or on to wooden slips supported by a bracket.

Imms (A. D.). **Recent Advances in Entomology.**—Demy 8vo, viii+374 pp., 84 figs. London, J. & A. Churchill, 1931. Price 12*s*. 6*d*.

The enormous growth of entomological literature of recent years has rendered it impossible for the individual to keep in touch with all aspects of it, especially as these are themselves increasing both in numbers and complexity.

This book should therefore be of great value, in that it summarises in a compact form the more recent additions to knowledge on a number of selected subjects.

The contents comprise two chapters devoted to morphology, one each to metamorphosis and palaeontology, two to the sense organs

and reflex behaviour, one to the fundamental aspect of coloration, four to some aspects of ecology and to its practical application, and two each to parasitism and biological control. A short but well selected bibliography is appended to each.

WILLIAMS (C. B.). **The Migration of Butterflies.**—Demy 8vo, xi+473 pp., 71 figs., 27 pp. refs. Edinburgh & London, Oliver & Boyd, 1930. Price 21*s*. net.

This work contains a large amount of data relating to observed migrations of butterflies in various parts of the world, mainly in the tropics, followed by a discussion of the nature and significance of the phenomena observed. Though a great deal more information is obviously needed, the data already collected may well prove to be of value in connection with the migration of insects of greater economic importance, such as locusts. The very extensive bibliography is a valuable addition to the book.

PAILLOT (A.). **Traité des maladies du ver à soie.**—Roy. 8vo, 279+vi pp., 99 figs., numerous refs. Paris, G. Doin & Cie., 1930. Price *Frs*. 40.

This comprehensive work on the diseases of *Bombyx mori*, L., is divided into four parts, the first of which deals with the anatomy, histology and physiology of the normal silkworm. The second part is devoted to muscardine and pebrine ; the third to the infectious virus diseases, grasserie, gattine and true flacherie ; and the fourth to two types of dysentery, pseudo-flacherie and preventive measures against intestinal diseases of silkworms generally. Although the whole work, even where it deals with well-known diseases such as muscardine and pebrine, is obviously the result of individual study, the most definitely original sections are those dealing with grasserie and the microbic dysenteries, in which the author clearly indicates the part played by filtrable viruses in association with bacteria in the origin of polyhedral diseases and diseases of the intestinal tract, which have until now been more or less confused under the name of flacherie.

THORPE (W. H.). **Biological Races in Insects and allied Groups.** – *Biol. Rev.*, v, no. 3, pp. 177–212, 5 pp. refs. Cambridge, July 1930.

This paper is a review and discussion of the more important literature bearing on the subject of biological races. The cases discussed chiefly concern insects, although reference is made to certain instances occurring in the Myriapoda, Crustacea, Arachnida, and particularly Nematodes. The author states that a biological race may be said to exist where the individuals of a species can be divided into groups, usually isolated to some extent by food preferences, occurring in the same locality and showing definite differences in biology, but with corresponding structural differences either few or inconstant, or completely absent.

The paper is divided into two main sections, the first dealing with the biological races occurring naturally, the second with those produced experimentally. Instances of true biological races, as defined above,

attached to different food-plants, are found in *Pegomyia hyoscyami*, Panz., with at least two races, one attacking Chenopodiaceae and the other Solanaceae ; *Rhagoletis pomonella*, Walsh, with one race infesting apples and another blueberries ; and *Hyponomeuta padellus*, L., on apple and *Crataegus* [see next paper].

A large group of cases is concerned with insects that exhibit biological differentiations associated with geographical isolation. Instances of this include *Trialeurodes vaporariorum*, Westw., parthenogenetic eggs of which produce males in one race, females in another ; and species of *Chermes*, *Phylloxera*, and other Aphids. Among parasitic insects the phenomenon is well developed in *Trichogramma evanescens*, Westw., and *T. cacoeciae*, Marchal [*R.A.E.*, A, xv, 653], and also in certain Tachinids. An interesting instance of two races of a host differing in ability to resist parasitism is supplied by *Chrysomphalus aurantii*, Mask., in its relation to the parasite, *Comperiella bifasciata*, How. [xv, 249]. Instances of biological races in Arthropods parasitic on man and animals are also reviewed.

Cases in which biological races have apparently been produced experimentally include the transference of *Lecanium corni*, Bch., from peach to *Robinia* by Marchal ; of *Lasiocampa quercus*, L., from oak to pine by Pictet ; and of *Pontania viminalis*, L. (*salicis*, Christ), from one species of willow to another by Harrison. In this section, the author also discusses the development of strains resistant to hydrocyanic acid gas in *Chrysomphalus aurantii*, *Saissetia oleae*, Bern., and *Aspidiotus perniciosus*, Comst.

The bearing of the study of biological races on theories of evolution is discussed. Though the origin and spread of such races is most easily explained by some form of Lamarckian hypothesis, it is not considered that any of the cases discussed provide really satisfactory evidence for such a theory.

THORPE (W. H.). **Biological Races in** *Hyponomeuta padella* **L.**—*J. Linn. Soc.*, Zool., xxxvi, pp. 621–634, 12 refs. London, May 1929.

A detailed study of the adult and larval morphology of *Hyponomeuta padellus*, L., which usually attacks hawthorn (*Crataegus oxyacantha*) and blackthorn (*Prunus spinosa*), and *H. malinellus*, Zell., which attacks apple [*cf. R.A.E.*, A, xvi, 622], leads the author to conclude that the latter is not specifically distinct from the former, as the structural differences are not constant (though *H. cognatellus*, Hb., which occurs on *Euonymus* and which was used for comparison, can be differentiated). On the other hand strong evidence that two distinct biological races are concerned was obtained by experiments on the feeding habits of the larvae, oviposition responses and mating preferences. A brief account of the bionomics of *H. padellus* in Britain is given. Though infestation of apple by the hawthorn form does not appear likely to occur, a severe attack on hawthorn near an orchard should enable the grower to be ready to deal effectively with the early stages of an outbreak on apple should it take place. If both hawthorn and apple are attacked, it might be advantageous to leave the hawthorn form, thereby keeping a supply of parasites ready to attack any infestation of apple that occurs.

LEVER (R. J. A. W.). **Notes on Nomenclature of some neotropical Chrysomelidae (Coleoptera), with Descriptions of two new Species.**—*Ann. Mag. Nat. Hist.*, (10) vi, no. 36, pp. 668–671, 5 figs., 6 refs. London, December 1930.

The Galerucid, *Diabrotica vittata*, F., is a synonym of *D. melanocephala*, F., 1775. The beetle known as *D. melanocephala*, which was described by Fabricius under that name in 1798, is distinct, and the next available name for it is *D. tripunctata*, F. *D. rubrimarginata*, sp. n., on *Crotalaria juncea* (sunn hemp) and *Canavalia*, and the Clytrid, *Dachrys trinidadensis*, sp. n., on *C. juncea*, and less frequently on *C. usaramoensis* and *Stizolobium aterrimum* (Bengal bean) are described from Trinidad.

SCHØYEN (T. H.). **Beretning om skadeinsektenes optreden i land- og havebruket i årene 1928 og 1929.** [Report on Insects injurious to Agriculture and Horticulture in 1928 and 1929.]—*Landbruksdirekt. Årsberet. 1928–1929*, pp. C 1–C 36, 23 figs. Oslo, 1930.

Pests recorded in Norway in 1928 and 1929 and not mentioned in the previous report [*R.A.E.*, A, xvii, 251] include *Hypera* (*Phytonomus*) *polygoni*, L., and *Phorbia* (*Chortophila*) *genitalis*, Schnabl, on wheat, and *Trachea* (*Hadena*) *secalis*, L., on rye. It is suggested that a considerable proportion of the injury to oats attributed to *Hydrellia griseola*, Fall., is probably due to *Phytomyza avenae*, de Meij., a leaf-miner described from Sweden in 1926, which it closely resembles. Grasses were attacked by *Limothrips denticornis*, Hal.; several leguminous plants by *Euxoa* (*Agrotis*) *segetum*, Schiff.; potatoes by *Gortyna* (*Hydroecia*) *micacea*, Esp., and *Rhizoglyphus echinopus*, F. & R.; tomatos by *Myzus persicae*, Sulz. (*Rhopalosiphum dianthi*, Schr.), *Trialeurodes* (*Aleurodes*) *vaporariorum*, Westw., and *Agrotis c-nigrum*, L.; beet by *Blitophaga* (*Silpha*) *opaca*, L., and *Pegomyia hyoscyami*, Panz.; and crucifers by *Nabis ferus*, L., *Uropoda obnoxia*, Reut., *Phaedon armoraciae*, L., *Ceuthorrhynchus quadridens*, Panz., *Tipula oleracea*, L., and *Contarinia nasturtii*, Kieff. *Trioza viridula*, Zett., which is the most serious insect pest in Norway, has caused an alarming degree of injury to carrots during the past two years. The control measures given are similar to those noticed from Sweden [*R.A.E.*, A, xviii, 231]. *Psila rosae*, F., has occurred frequently over a wide area, attacking both carrots and celery. Parsnips were infested by *Aphis fabae*, Scop., and onions by *Hylemyia* (*Anthomyia*) *antiqua*, Mg. Pests of apple included *Psylla pyricola*, Först., *Anuraphis* (*Aphis*) *sorbi*, Kalt., adults of *Limonius aeruginosus*, Ol., *Eupsilia* (*Scopelosoma*) *satellitia*, L., which also attacks pears, *Exapate congelatella*, Cl., *Eriophyes pyri*,, Pag., and *E. malinus*, Nal. Pears and plums were attacked by *Phyllobius pyri*, L., plums by *Lepidosaphes ulmi*, L., *Brachionycha* (*Asteroscopus*) *nubeculosa*, Esp., *Cheimatobia brumata*, L., *Eriophyes similis*, Nal., and *E. padi*, Nal., and peaches by *Eucosma* (*Tmetocera*) *ocellana*, Schiff. *Formica rufa*, L., attacked the blossom of young plum trees and destroyed the fruit. *Taeniothrips inconsequens*, Uzel, *Chloroclystis rectangulata*, L., *Biston hirtaria*, Cl., and *Caliroa* (*Eriocampoides*) *limacina*, Retz., occurred on cherry; *Thamnonoma wavaria*, L., on black currant; *Galerucella tenella*, L., and *Peronea* (*Acalla*) *comariana*, Zell., on strawberry; and *Batophila rubi*, Payk.,

Pennisetia (*Bembecia*) *hylaciformis*, Lasp., and *Incurvaria capitella*, Cl., on raspberry.

Notes are also given on the pests of ornamental plants, the insects infesting foodstuffs, and those found in houses.

Lindblom (A.). **Hallonviveln** (*Anthonomus rubi* **Herbst) ett för vissa delar av vårt land mycket betydelsefullt skadedjur.** [The Raspberry Weevil, *Anthonomus rubi*, Hbst., an important Pest in some Parts of Sweden.]—*Medd. CentAnst. Försöksv. Jordbr.*, no. 375, *Lantbruksentom. Avd.*, no. 60, 39 pp., 13 figs., 55 refs. Stockholm, 1930. (With a Summary in German.)

Lindblom (A.). **Hallonvivelns bekämpende.** [The Control of the Raspberry Weevil.]—*Flygbl. CentAnst. Jordbr. Försöksv.*, no. 148, *Lantbruksentom. Avd.*, no. 38, 4 pp., 3 figs. Stockholm, April 1930.

Anthonomus rubi, Hbst., all stages of which are described, has caused considerable injury to strawberry, particularly in 1928 and 1929, when the damage was estimated at 67 per cent. of the crop, on several islands in the neighbourhood of Stockholm. Other food-plants include roses, raspberry, etc. The weevil hibernates as an adult among grass and litter. The female bores into the bud and pushes an egg through to the heart. The pedicel is partly or entirely cut through, so that the bud cannot open. The egg hatches in 5–6 days, and the larva, which matures in 18–22 days, feeds and eventually pupates within the bud. The weevil emerges 8 days later and leaves the bud, but does not become sexually mature until the following year. In addition to severing the buds, the weevils injure the blossom by feeding on the pollen, and later attack the unripe fruit, which is deformed.

In addition to the collection and destruction of the weevils and infested buds, *A. rubi* may be controlled by spraying with petroleum soap emulsion, barium chloride, arsenicals, or a mixture consisting of 2½ lb. finely ground hellebore, 7½ lb. soft soap, 3 pts. paraffin and 100 gals. water; or by dusting with nicotine powder, calcium chloride, lead arsenate or flowers of sulphur (1 : 5). Although no variety of garden strawberry showed any resistance to the attack of *A. rubi*, the early ones suffered less on the whole. The cause of the serious injury in the neighbourhood of Stockholm is probably lack of proper crop rotation. Each strawberry or raspberry plantation should consist of several varieties with different dates of maturity. The plants should be dusted with arsenical powder during May, and this treatment should be repeated once or twice as required, but not after the fruit is set. After the crop has been gathered, another application of dust should be made if any weevils are observed during the work.

Lundblad (O.). **Lilla vinbärsmalen** *Incurvaria trimaculella quadrimaculella* **Höfn., en som skadedjur pa vinbär hittills okänd och för vårt land ny malfjäril.** [*Incurvaria trimaculella quadrimaculella*, Höfn., a Moth hitherto unknown as a Pest of Currants and new to Sweden.]—*Medd. CentAnst. Försöksv. Jordbr.*, no. 374, *Lantbruksentom. Avd.*, no. 59, 25 pp., 13 figs., 21 refs. Stockholm, 1930. (With a Summary in German.)

A few years ago black and red currants in the north of Sweden were found to be attacked by *Incurvaria trimaculella quadrimaculella*, Höfn.,

which had never previously been recorded nearer to Sweden than the Alps. The typical *I. trimaculella*, H.-S., lives on *Saxifraga rotundifolia*, which does not occur in Sweden. The habits of the south European form are unknown, but it has been taken in places where *S. rotundifolia* does not occur.

In Sweden the eggs were laid on the lower surface of the leaves of currant, and the larvae began to mine as soon as they had hatched. A detailed description is given of the manner in which the larvae mine the leaf and subsequently cut out small circular pieces and form them into shelters in which they live independently on the leaf. The mature larva pupates on the ground in a green shelter that is more regularly oval than the one in which it lives on the leaf. Hibernation takes place in the pupal stage, and the first moths appear in May. Oviposition begins in the first half of June, and at the end of that month the larvae generally pass from the mining stage to that in which they live independently on the leaf. By about 25th July, all the larvae have left the bush. Only one generation occurs yearly. The eggs and the young mining larvae may be killed by spraying with various nicotine preparations, and arsenicals are effective against the more mature larvae. Litter should be removed from beneath the bushes in autumn, and the ground around them should be first dug and then stamped down firmly.

Plantesygdomme i Danmark 1929. [Plant Diseases and Pests in Denmark in 1929.]—*Tidsskr. Planteavl*, xxxvi, pp. 506–558, 2 charts, 2 figs. ; also as *Oversigt St. Plantepat. Forsøg.*, no. 46. Copenhagen, 1930. (With a Summary in English.)

Pests occurring in Denmark in 1929 include : *Tipula paludosa*, Mg., the autumn larvae of which attacked rye fields sown after grass in large numbers ; *Anthonomus rubi*, Hbst., which was common on strawberry ; and *Paratetranychus pilosus*, C. & F., which has recently developed into a serious orchard pest, attacking particularly plum and apple. Insects recorded for the first time as pests in Denmark are *Psylliodes affinis*, Payk., on potato and *Ceuthorrhynchus contractus*, Mshm., on crucifers. The winter eggs of *P. pilosus* were killed by various oil emulsions, but their effect should be supplemented by summer sprays ; one containing 1 per cent. oil, applied in August, produced a marked reduction in oviposition.

Brāmanis (L.). **Die Bedeutung der Kiefernstubben auf den Kahlschlägen für die Entwicklung des Rüsselkäfers** *Hylobius abietis* **L.** [The Importance of Pine Stumps in clear-felled Areas for the Development of the Weevil, *H. abietis*.]—*Folia zool. hydrobiol.*, i, no. 2, pp. 168–177, 1 pl. Riga, 20th May 1930. (With a Summary in Lettish.)

Investigations were made in 1925–28 in Latvia to ascertain the importance of pine stumps left in cleared forest areas in the increase of *Hylobius abietis*, L., and to find in what portions of such stumps this weevil is most abundant. Most of the larvae and pupae occurred in horizontal roots, very few being found in the vertical ones, or in the stumps above ground. On an average, 5–6 individuals were found to 40 inches of horizontal root. No pests, except *Hylastes*, occurred

deeper than 32–34 inches. In eleven stumps there were 2,366 larvae and pupae of *Hylobius abietis*, of which 175 were parasitised. The average percentage of parasitism was 3·5, except in three stumps where it was 20·26, a difference believed to be due to the fact that examination of these stumps was postponed for a fortnight instead of taking place immediately they were dug up, thus allowing many larvae to be parasitised by *Mesostenus gladiator*, Scop. It would appear that stumps left in clear fellings are the chief cause of increase of *H. abietis* ; they should be removed at the latest in the spring of the second year after felling. Only one generation develops in the stumps. The injury is greatest in the spring after the trees are felled, when the adults are attracted by the smell of the fresh resin, and in the autumn of the second year, when most of the young adults leave the stumps. Most of the larvae have developed sufficiently by the autumn of the first year to begin preparing the pupal chambers in which they pupate in the following June or July, the majority of the young adults leaving the stumps to feed in autumn. This feeding is less marked than the post-hibernation feeding in the next spring. The parasites reared were *Ephialtes tuberculatus*, Fourcr., and *M. gladiator*. Several Diptera, probably Syrphids, failed to yield adults.

Concurrently with the above investigations, an examination was made to ascertain the infestation in standing trees [*cf. R.A.E.*, A, xv, 207].

Crüger (O.) & Körting (A.). **Beitrag zur Frage der Fritfliegenbekämpfung am Winterroggen.** [A Contribution to the Question of the Control of the Frit-fly on Winter Rye.]—*Z. PflKrankh.*, xl, no. 9–10, pp. 416–430, 7 figs., 8 refs. Stuttgart, 1930.

In Germany attempts are made, by early sowing of summer cereals and late sowing of winter ones, to ensure that the plants are not exposed in a susceptible condition to attack by *Oscinella frit*, L. Hitherto it has not seemed possible to ascertain the correct times by the help of phenological data, and the observations made in East Prussia in 1929 and described here indicate this view to be correct. It is not possible to lay down a rule applicable to the coldest parts of the Province, because the danger of frost requires winter rye to be sown at a time (1st–10th September) when there is still danger of infestation, instead of from the calculated correct date of 9th onwards. It is calculated that in the west and south-west (the warmest parts) sowing before 17th September entails a great risk of attack ; the date for the northern and central area is the 11th September. These dates agree with those in use locally as a result of long practice, namely, 15th–20th and 10th–15th September. There does not seem to be any relation between the preceding crop and the degree of infestation of winter rye.

Hesse (E.). **Insectenfrass an** *Lilium martagon* **L.** [Insects Feeding on *L. martagon*.]—*Z. wiss. InsektBiol.*, xxv, no. 3–5, pp. 88–89. Berlin, 20th August 1930.

The Noctuids, *Taeniocampa pulverulenta*, Esp., and *Calymnia trapezina*, L., *Tortrix* (*Cacoecia*) *crataegana*, Hb., and a beetle, *Crioceris lilii*, Scop., have been observed attacking *Lilium martagon* in Brandenburg.

Prell (H.). **Ulmensterben und Ulmenborkenkäfer.** [Elm Disease and Elm Bark-beetles.]—*Die kranke Pflanze*, vii, nos. 7–9, pp. 89–93, 103–105, 124–127. Dresden, July–September 1930.

Dutch elm disease, caused by *Graphium ulmi*, which has been observed over nearly the whole of Europe during the past decade, has appeared in Saxony. The fungus is spread chiefly by bark-beetles, especially *Scolytus scolytus*, F. [*cf. R.A.E.*, A, xviii, 177], and simultaneous attack by the fungus and the beetle usually kills the tree. The measures recommended are similar to those suggested in Holland [*loc. cit.*]. The barked timber should be stored in airy, dry conditions.

Bodenheimer (F. S.). **Ueber die Grundlagen einer allgemeinen Epidemiologie der Insektenkalamitäten.** [On the Bases of a general Epidemiology of Insect Outbreaks.]—*Z. angew. Ent.*, xvi, no. 3, pp. 433–450, 5 figs., 22 refs. Berlin, August 1930.

This paper is a recapitulation of published data by the author [*R.A.E.*, A, xiv, 415 ; xvii, 489 ; xviii, 184, etc.].

Bodenheimer (F. S.). **Ueber einige Grundfragen der Insekten-Epidemiologie. Offener Brief an Herrn Kollegen Janisch.** [On some basic Questions of Insect Epidemiology. An open Letter to Herr Janisch.]—*Z. angew. Ent.*, xvi, no. 2, pp. 606–611. Berlin, August 1930.

In this reply to a criticism of the concept of critical thermal points [*R.A.E.*, A, xviii, 241], it is stated that such points, and not the optimum temperature for development, are of primary importance in studying the factors concerned in outbreaks of insects.

Körting (A.). **Beitrag zur Kenntnis der Lebensgewohnheiten und der phytopathogenen Bedeutung einiger an Getreide lebender Thysanopteren.** [A Contribution to the Knowledge of the Life-history and Importance in Relation to Plant Diseases of some Thysanoptera living on Cereals.]—*Z. angew. Ent.*, xvi, no. 3, pp. 451–512, 22 figs., 61 refs. Berlin, August 1930.

Several species of thrips that infest cereals have long been regarded as injurious, causing white-ear, etc., though doubt has been thrown on this by Jablonowski and others [*cf. R.A.E.*, A, xv, 52]. In North Germany in 1926–28 the author studied the biology of the two commonest species there, *Limothrips cerealium*, Hal., and *Haplothrips aculeatus*, F., and especially their incidence in relation to that of white-ear.

L. cerealium oviposits chiefly in rye and oats. Data relating to the duration of development, which is greatly influenced by temperature, as obtained in the laboratory are given in detail, and these agree with those obtained in the field, where at 18·5° C. [65·3° F.] 17–19 days passed between hatching of the larva and emergence of the adult, and the egg-stage lasted about 9 days. The males develop more quickly than the females. Two generations a year occurred, the first in June and the first half of July, and the

second in the last third of July and first half of August. The females of the second generation hibernate and reappear about April. Massed assemblies of this thrips may occur at a minimum temperature of 18°–20° C. [64·4°–68° F.] and in the absence of strong winds, but there did not appear to be any relation between atmospheric pressure and the size of the swarm.

H. aculeatus was rarely present in the swarms, and then only in small numbers. Hibernated adults of this species wander about on grasses, etc., after leaving their winter quarters. They breed on winter rye in May and on wheat and oats in July. The adults of the new generation first appear at the end of July, and in the second half of August migration to winter quarters begins. *L. cerealium* hibernates chiefly under the bark of trees and in houses ; *H. aculeatus* is found among graminaceous plants and fallen leaves in low-lying, damp situations, and *Limothrips denticornis*, Hal. (a third species fairly common near Kiel, where this work was done), occurs in the same shelters, but in higher, drier places. Only rarely were thrips found hibernating in cereal stubble.

The investigations on the relation of thrips to white-ear disease are described in detail. There does not appear to be any relation between their abundance and severity of white-ear, and experimentally infested plants did not show any greater degree of white-ear than plants kept free from infestation. It is therefore concluded that *L. cerealium* and *H. aculeatus* at least are not the cause of white-ear in rye, oats, or barley, and probably not in wheat, though further tests with this crop are needed.

SCHWERDTFEGER (F.). **Untersuchungen über Dauer des Eistadiums, Wachstum und Stoffwechsel des Kiefernspanners** (*Bupalus piniarius* **L.**). [Investigations on the Duration of the Egg-stage, Growth and Metabolism of the Pine Geometrid, *B. piniarius*.]—*Z. angew. Ent.*, xvi, no. 3, pp. 513–526, 5 figs. Berlin, August 1930.

The egg-stage of *Bupalus piniarius*, L., was found experimentally to last from 13 days at 21·5° C. [70·7° F.] to 31 days at 14° C. [57·2° F.]. The larval stage occupied about 70 days, and during this period an individual consumes 1·22 gm. or 38 fresh pine needles. On this basis, about 12,000 larvae can defoliate a 60-year-old tree, but in practice about 3,000 suffice, as many injured needles fall and others wither without being eaten.

RIPPER (W.). **Champignon-Springschwänze. Biologie und Bekämpfung von** *Hypogastrura manubrialis* **Tullbg.** [Mushroom Collembola. The Biology and Control of *H. manubrialis*.]—*Z. angew. Ent.*, xvi, no. 2, pp. 546–584, 18 figs., 19 refs. Berlin, August 1930.

In Austria, Collembola cause great losses in mushroom cultivation, and an outbreak in 1928 of *Hypogastrura manubrialis*, Tullb., var. *assimilis*, Krausbauer, not previously recorded as a pest of mushrooms, led to a study of its ecology. The characters differentiating it from

another cosmopolitan species, *H. armata*, Nic., are given, and its bionomics are dealt with in detail. All stages mine the mushrooms, the short, irregularly branched tunnels being easily distinguished from the longer mines of Dipterous larvae. Feeding causes rapid putrefaction.

In the laboratory the females oviposit at intervals of 12–14 days, the eggs being laid in heaps of about 30. The young hatch in about 3 weeks and become sexually mature in 5–7 weeks. Both before and after maturity, moulting occurs at intervals of 5–7 days. The length of life is 5–10 months, and individuals can resist starvation for over 40 days. They require a very moist atmosphere, but can live and reproduce at temperatures between a little above freezing point and 22° C. [71·6° F.]. Temperatures below −13° C. [8·6° F.] or above 40° C. [104° F.] are fatal to them, so that they can be destroyed by heating the manure when preparing it. Of the other fauna of mushroom beds, only Gamasid mites and some Staphylinid larvae and adults prey on the Collembola, and they are of no practical importance.

Measures against outbreaks include disinfection during preparation of the beds by fumigation with sulphur and the use of sterile manure. Control when infestation is established is difficult; pyrethrum powder does not destroy the eggs and is very costly, tobacco dust is ineffective, and hydrocyanic acid gas is not toxic enough at strengths that do not affect the mushrooms. Paradichlorobenzene at the rate of 5–6 oz. to 1,000 cu. ft. proved fatal and did not poison the mushrooms, though their market value is lowered unless its clinging odour can be got rid of by thorough airing. The eggs are killed by paradichlorobenzene at the rate of 8 oz. to 1,000 cu. ft., but both these and the later stages are very resistant to insecticides, and a cheap remedy still remains to be discovered.

Werneck (H. L.). **Das grünliche Spitzmäuschen** (*Apion virens* **Hbst.**). **Neu als verheerender Schädling der Rotkleebestände (Wurzelhals und Herzteil).** [*A. virens*, new as a devastating Pest of Red Clover (Root Collar and Heart).]—*Z. angew. Ent.*, xvi, no. 2, pp. 585–591, 1 fig. Berlin, August 1930.

In April and May 1926 red clover plants in Upper Austria showed a peculiarly stunted condition, which was due to the presence of larvae of the weevil, *Apion virens*, Hbst., at the roots. In 1926 and 1929 up to 80 per cent. of the plants in some fields were attacked, though in the intervening years the infestation dropped to 10–20 per cent.

The eggs are laid on the root-collar or stems, and the minute larvae may be found on young clover in September or November. They hibernate in the tap-root, and by April or May have made their way up into the heart of the plant. They pupate early in July, and after a few days the weevils emerge and seek young clover fields in order to oviposit. Oviposition seems to be over by the end of July. The adults probably die or seek winter quarters deep in the ground. There is apparently only one generation a year. An important point is that the adults appear just when the cereals have been harvested and when the clover is exposed without having begun to grow vigorously.

Klein (H. Z.). **Zur Lebensgeschichte und Epidemiologie der Getreidemotte** *Sitotroga cerealella* **Oliv.** [On the Life-history and Epidemiology of the Grain Moth, *S. cerealella*.]—*Anz. Schädlingsk.*, vi, no. 9, pp. 97–101, 2 figs. Berlin, 15th September 1930.

On the suggestion of Bodenheimer, who gave a temperature curve for the development of *Sitotroga cerealella*, Ol. [*R.A.E.*, A, xiv, 416], data on the subject were obtained by breeding experiments in stored barley, the results of which are summarised as follows: *S. cerealella* has 5–6 generations a year in the coastal zone of Palestine. The developmental zero point is 10·3° C. [50·54° F.] and the thermal constant (in day-degrees) 474° C. [*cf.* xiii, 389]. From 80 to 180 eggs are laid by a female, and the sexes are equal in numbers. Although the development potential of a single pair is equal to 30 milliard moths a year (with 6 generations), the actual progeny in the coastal region of Palestine amounts only to 400–450. The extreme temperatures in winter and summer so reduce the numbers that there is little difference from year to year.

Martini (E.). **Kann man die Geschwindigkeiten, mit denen verschiedene Lebensphasen der Insekten durchlaufen werden, vergleichen?** [Is it possible to compare the Speeds at which various Life-phases of Insects are traversed ?]—*Anz. Schädlingsk.*, vi, no. 9, pp. 101–107. Berlin, 15th September 1930.

This paper discusses Janisch's work on the dependence of insect development on temperature [*R.A.E.*, A, xviii, 241].

Fedorov (S. M.). **Tobacco Thrips** (*Thrips tabaci* **Lind.**) **as a Pest of Tobacco Plant in Crimea.**—*Eos*, vi, no. 3, pp. 229–248, 10 figs., 9 refs. Madrid, November 1930.

A detailed account is given of the bionomics of *Thrips tabaci*, Lind., on tobacco in Crimea [*cf. R.A.E.*, A, xvii, 477]. All its stages are figured, and the pronymph and nymph are fully described. A list of its food-plants is given, and the type of injury caused to the leaves of tobacco and its effect on the quality of the crop are discussed. Remedial measures include rotation of crops and clean cultivation. Insecticides are too expensive for general use, though effective control can be obtained by spraying with 2 per cent. soap solution or 0·05 per cent. tobacco extract. The spray should be applied in early spring, particularly in the case of the soap, and should be repeated after 4 or 5 days.

[Nevskiĭ (V. P.).] **Невский (В. П.). A brief Guide to the Methods of Control of agricultural Pests in the Uzbek Soviet Republic.** [*In Russian.*]—Fscap. 8vo, 72 pp., 1 ref. Tashkent, Uzbekist. opuitn. Sta. Zashch. Rast., 1930. Price *kop.* 60.

Notes are given on the insecticides (including baits and fumigants) and other measures that are used against pests of crops and stored products in Uzbekistan, and the methods of preparing and using the insecticides are described.

Lang (W.) & Welte (E.). **Zur Prüfung staubförmiger Erdflohmittel.** [On the Testing of Dust Insecticides for Flea-beetles.]—*Nachr Bl. deuts. PflSchDienst*, x, no. 9, pp. 75–76, 2 figs. Berlin, September 1930.

An apparatus used for testing the toxicity of dusts to flea-beetles is described. A wire gauze cylinder about 8 inches high and 13 inches in diameter is placed on a sheet of ground glass. A smaller glass bell is stood on the plate inside the cylinder. The top of the bell has a bottle neck that can be closed with a rubber stopper with 2 small air-holes and a third larger hole through which is passed the vertical leg of a glass tube bent in the middle at a right angle. The tube narrows to the opening inside the bell, and the dust is blown through it by a bellows attached by rubber tubing to the other end. About ¼ inch away from the tip of the glass tube a brass cone is held by struts (attached to it) so as to act as a spreader for the dust. In use the horizontal portion of the tube is charged with a measured quantity of the dust, the beetles are poured into the bell through the neck, which is then closed with the stopper carrying the dusting tube, and the dust is blown in with a moderately rapid puff. Ten seconds later the bell is removed and the cylinder covered with a sheet of clear glass to permit of observation. The results obtained with a number of proprietary dusts on *Phyllotreta nigripes*, F., are tabulated.

Hall (W. J.). **The South African Citrus Thrips in Southern Rhodesia.** —*Pub. Brit. S. Afr. Co.*, no. 1, 56 pp., 8 pls., 36 refs. London & Salisbury, Rhodesia, August 1930.

Scirtothrips aurantii, Faure, all stages of which are described, is a major pest of *Citrus* in Southern Rhodesia. It was probably introduced on almond trees imported from the Union of South Africa a few years prior to 1922, and has become widely distributed throughout the colony. Its history and distribution in South Africa are reviewed. It is probable that its spread was effected by transport of infested nursery stock, although local distribution may also be caused by adults, which are induced to fly by shortage of food, and are carried considerable distances by wind. Only the young fruit and the new foliage are attacked. The fruit usually becomes infested towards the end of September, 3–4 weeks after the petals have fallen, and when it is 0·7 cm. in diameter. Feeding continues until late in November, when the thrips migrate to the new foliage that has been brought out by the early rains. This usually occurs when the fruit is about 3 cm. in diameter. The remainder of the year is passed on the foliage, the upper surface of the leaves being usually attacked.

Observations show that reproduction occurs parthenogenetically; although males have been found, they are scarce and mating has not been observed. Oviposition probably begins 2–3 days after the emergence of the adults, the eggs being laid chiefly within the tissues of the young fruits, sepals or leaves. Both larvae and adults are attracted to light, but are repelled by strong sunlight. A drop of water falling directly on them will cause death if it strikes them hard, and it is thought probable that the mechanical action of rain, which kills some and washes others off the trees, is responsible for the reduction in the degree of infestation when the rainy period begins. The larvae

were observed to experience some difficulty in hatching from the eggs, and the mortality among them, both in the field and the laboratory, was comparatively high. Pupation in the field takes place on the fruit, when the latter is infested, or in a sheltered position on the tree. The methods of studying the life-history of the thrips both in the field and the insectary are described. The average periods required for development in days were, egg 8·63, larva 5·12 and pupa 3·92. The complete life-cycle, from egg to egg, during the months of October and November required 20·17 days. The adults probably live about 30 days. The thrips do not hibernate and are present on the trees at all times of the year. Various factors influencing their abundance, rate of development, etc., are discussed. The conditions most likely to produce a severe infestation appear to be those of low rainfall and a mild winter during the preceding twelve months. There is some evidence that development is influenced by the degree of relative humidity, since when the latter is high, the life-cycle is prolonged and the rate of mortality is therefore increased. As there is little new foliage in the dormant season, the quantity of out-of-season fruit on the trees from April until August is an important factor in influencing the degree of infestation from September to the end of November, since any individuals that have survived until April subsist until the new crop appears in August on any fruit or young foliage that may be on the trees. The removal of all such fruit during April and May would reduce the subsequent degree of infestation, whatever the rainfall of the preceding summer might have been. There is a distinct relationship between infestation of thrips and abundance of food, except that during rains when food is abundant the infestation gradually diminishes.

Surface injury to the fruit in general, and the relationship of thrips injury to "tear-staining" [*R.A.E.*, A, xviii, 633], which is caused as a result of the action on the sound tissues of the fruit of the oil liberated from the oil glands of the rind, are discussed. Another form of serious damage to the fruit, known as "russety marking," which also indirectly results from thrips injury, takes place if the climatic conditions that cause "tear-staining" (heavy showers and storms followed by bright sunshine) do not occur until February or March. Although it is not usually so prevalent as "tear-staining," it is much more serious than any other type of injury when it does occur.

The control of the thrips by spraying is discussed in detail; the recommendations made have already been noticed [*loc. cit.*]. Apart from its action as a contact insecticide, lime-sulphur produces a secondary effect, which reduces considerably the numbers of thrips that survive the spraying operation. Experiments showed that this is twofold: firstly, the lime-sulphur acts as a stomach poison, and secondly, by the liberation of sulphur dioxide as a decomposition product, it creates an atmosphere unfavourable to the thrips.

Decary (R.). **La destruction des cactus par une cochenille à Madagascar : ses conséquences économiques et sociales.**—*Ann. Soc. linn. Lyon*, lxxv (1929), pp. 101–117, 8 refs. Lyons, 1930.

Dactylopius coccus, Costa, introduced into southern Madagascar in 1925, has almost completely destroyed *Opuntia dillenii*, an essential local food and fodder plant. To avoid depopulation of the district, the author urges the introduction of some spineless species of *Opuntia*

that possesses the useful properties of *O. dillenii*, but is immune from attack by the Coccid. Research in this direction is being undertaken.

FRANSSEN (C. J. H.). **De levenswijze en bestrijding van den sjalottenuil (*Laphygma exigua* Hbn.) op Java.** [The Biology and Control of the Shallot Noctuid, *L. exigua*, in Java.]—*Meded. Inst. PlZiekt.*, no. 77, 25 pp., 3 pls., 7 refs. Buitenzorg, 1930. (With a Summary in English.)

The Noctuid, *Laphygma exigua*, Hb., all stages of which are briefly described, is a pest of shallots in Java, other species of *Allium* and maize being also attacked. The larva feeds on the leaves and in severe infestations on the bulbs as well. Injury of economic importance usually occurs only in low-lying districts, as development is slow in high situations, and may be avoided by proper crop rotation. The eggs are laid at night in clusters on the leaves and hatch after 3 days. The larval stage averages about 12 days and the pupal 8, pupation occurring just below the surface of the ground. The female, which lays an average of 1,000 eggs, lives about 8 days, and the male about 5. The sexes are equal in number. The natural enemies observed, which are, however, of little importance, were a Proctotrupid egg parasite very similar to *Phanurus beneficiens*, Zehnt., the female of which is briefly described, and a Braconid, an Ichneumonid and a Tachinid, which infest the larvae. The female, larva and cocoon of the Braconid are briefly described. It parasitises first-stage larvae almost exclusively and develops in about a fortnight.

HAZELHOFF (E. H.). **Entomologisch onderzoek.** [Entomological Investigation.]—*Jaarsversl. Proefst. Java Suiker Ind. 1929*, pp. 113–134. Surabaya, 1930.

Brief notes are given on studies of *Encarsia flavoscutellum*, Zehnt., the Chalcid parasite of the white woolly aphis [*Oregma lanigera*, Zehnt.] on sugar-cane [*R.A.E.*, A, xvii, 629, 630]. In West Java the cane tip-borer, *Scirpophaga intacta*, Sn., was 4–8 times as abundant as in East Java. It was found that the date of planting has little influence on the final infestation and that the number of larvae and pupae does not increase in the old cane between May and August. About 80 per cent. of the newly hatched larvae die before they have succeeded in causing injury, but varieties of cane differ greatly in susceptibility to infestation, apparently because differences in the hardness of the leaf-buds offer greater or less resistance to the progress of the borer towards the growing point. The variation in injury between the moist and dry regions in Java is also probably due to this. Methods for ascertaining the infestation of cane by *S. intacta* are discussed [see next paper]. The best method of control is the systematic removal of infested shoots, success depending largely on the method of checking the results and the enforcement of fines for infested shoots left on the canes.

In searching for sugar-cane white grubs, the larvae of an Asilid fly were sometimes noticed; they appear to feed on those of *Lachnosterna* (*Holotrichia*) *helleri*, Brenske.

Hazelhoff (E. H.). **Methoden ter bepaling van topboorderaantasting en topboorderschade, II.** [Methods for the Estimation of the Infestation and Loss by Sugar-cane Tip-borers.]—*Arch. Suikerind. Ned.-Ind.*, 1930, no. 20, pp. 457–473. Surabaya, 1930. Also as *Korte Meded. Proefst. Java-Suikerind.*, 1930, no. 5. Pasoeroean, 1930.

At certain times an indication of the degree of infestation of sugar-cane and injury caused by *Scirpophaga intacta*, Sn., may be obtained by examination of canes brought in for sampling ripeness, but throughout the period of infestation examination in the field of several rows should be made to ascertain the number of infested canes and borers and of their parasites. As even incipient infestation must be noted, the examination must be a thorough one. New rows must be selected for each inspection. The work is done by gangs of four natives under European supervision and they are paid according to the infestations found. The loss is calculated by the weight of the canes and the percentage of sugar obtained. Methods of setting out the data in tables so as to permit of a definite estimate being made are shown.

Reports of the Bureau of Sugar Experiment Stations.—*Queensland Agric. J.*, xxxiv, pt. 2, pp. 129–137, 1 pl. Brisbane, 1st August 1930.

An account is given of the habits of *Mastotermes darwiniensis*, Frogg. (giant termite) studied by J. H. Buzacott in the Burdekin District of Queensland during May and June 1930. A nest extends from a few inches to several feet into the ground, and communicates by means of radiating galleries with such food as small trees, sugar-cane and other growing crops. The termites enter the cane, etc., by a small hole and eat out the contents of the stem, leaving only the thin rind without evidence of external injury until the growing point of the plant is affected and the heart leaves die. Practically all timbers are subject to attack, though some are more resistant than others.

This termite is particularly difficult to control as there is no external sign of the termitarium and no means of telling, without actually digging, whether a tree or stump attacked harbours a colony or is merely connected with a nest some distance away. Moreover, the value of arsenical poisons is greatly reduced by the fact that this species does not devour dead individuals. If posts used in buildings cannot be set in concrete, they should be treated with creosote, with a 10 per cent. solution of sodium arsenite or with crank case drainings in which a little arsenic has been dissolved.

When sugar-cane plantations are attacked, all timber, stumps and logs should be removed as far as possible. Any timber in which a nest is located should be treated by pouring in ½ pt. carbon bisulphide or 2 pts. benzine and blocking the openings. Baits consisting of 1 lb. arsenic to 50 lb. molasses may be poured into the nests, but this treatment should be varied as the termites learn to avoid the baits. As fence posts are a frequent source of infestation, steel posts should be employed, or if this is impossible and resistant wood cannot be obtained, all posts should be treated before use. With regard to the cane itself, the most effective measure is frequent heavy watering, which repels the termites. When one side or corner of a block shows heavier damage

than the rest, a furrow may be ploughed along the headland between the cane and the source of infestation, filled with bait and covered over. The bait consists of bran or sawdust, mixed with molasses or treacle and water to which arsenic has been added at the rate of approximately 1 lb. to 50 lb. of bait. Cane sticks containing termites should be broken and a certain amount of one of the above-mentioned baits poured down the hollow stem. Planting should be carried out with the ground as moist as possible or it should be well-watered after planting to prevent the termites destroying the young shoots. If no fumigants are available, nests should be broken open to allow the access of ants. This termite, although not a major pest of cane, is steadily spreading.

Experiments were undertaken by E. Jarvis to discover a spray for use against *Pseudococcus* that would be inexpensive and composed of materials that can be obtained locally. Practically 100 per cent. mortality of adults, nymphs and eggs together with the attendant ants was obtained with an emulsion of soap, kerosene and tobacco. The stock emulsion consists of $2\frac{1}{2}$ lb. soap, 2 qts. kerosene, $\frac{1}{2}$ lb. tobacco (black plug) and $1\frac{1}{2}$ gals. rain-water. This is melted and diluted with 6 parts water ; the whole is heated to a temperature of 50° C. [122° F.] and applied immediately.

Kunhi Kannan (K.). **The Coffee Berry Borer** (*Stephanoderes hampei*). **A preliminary Account.**—*Bull. Mysore Coffee Expt. Sta.*, no. 2, 12 pp., 2 pls., 2 figs. Bangalore, 1930.

An account is given of the bionomics of *Stephanoderes hampei*, Ferr. (coffee berry borer) in Java, compiled from the literature, for the benefit of coffee planters in South India, where it was detected in June 1930 [*R.A.E.*, A, xviii, 364], and measures that should be taken to eradicate it are indicated. It is possible that, at any rate in some districts, it might not become so serious a pest as it is in other countries, owing to the several months of hot weather between the successive crops, and the rains from June to about September. The way in which it may have been introduced is discussed [*cf.* xvi, 302] ; live beetles have recently been intercepted in tins of coffee seed from the Belgian Congo. Consignments of Java coffee are imported for market, and almost all the beans of this coffee are infested, showing holes and galleries and dead beetles inside. It is treated with boiling water on the estates to kill the beetles, but it is doubtful whether all estates observe this precaution.

Kondo (T.) & Miyahara (H.). **On** *Hypopta sibirica*, **Alph.** [*In Japanese.*]—*Oyo-Dobuts.-Zasshi*, ii, pp. 171–176, 10 figs. Tokyo, 1930.

The Cossid, *Hypopta sibirica*, Alph., all stages of which are described, is a serious pest of asparagus in southern Manchuria. It has one generation a year, the adults emerging at the beginning of June. The eggs are laid in the soil near the food-plant and hatch in 26 or 27 days. The larvae bore into the stalks and pupate in heavy soil in May. The collection of the larvae or pupae, or destroying them by ploughing in May, is recommended for control.

YUASA (H.). **A new Pest of Grape,** *Nodina chalcosoma,* **Baly.** [*In Japanese.*]—*Kontyû,* iv, pp. 201–204, 1 fig. Tokyo, 1930.

A description is given of the Eumolpid, *Nodina chalcosoma,* Baly, which attacks the stalks of grape-vines in the Okayama prefecture.

TAKAHASHI (R.). **Studies on** *Dendrolimus punctatus,* **Wlk.** [*In Japanese.*]—*Bull. Dept. Agric. Res. Inst. Formosa,* no. 76, 16 pp., 1 pl., 1 fig. Taihoku, 1930.

In the northern part of Formosa, *Dendrolimus punctatus,* Wlk., outbreaks of which occur at intervals of 5–7 years, causes serious damage to *Pinus luchuensis* and *P. massoniana,* which have long slender needles, and to a less extent to *P. thunbergi,* which has thick, shorter ones, the full-grown trees being preferred. The larvae are to be found throughout the year, but most of the injury is usually done in February and March, when the full-grown larvae are abundant. There are three generations a year, the moths emerging in March–April, mid-June, and August ; some of the larvae that hatch in March or April become inactive after the fifth instar, eating very little and growing slowly, and do not mature until January or February of the following year. The moths, which are attracted by light, are only active at night ; the males live on an average 6·8 days and the females 10·3. Oviposition begins on the first or second night after emergence, one female laying an average of 215 eggs. They occur in masses or rows, usually on the needles, and hatch in 10–14 days. The larval stage may last 33–290 days and includes 7–10 moults, the number increasing as the stage lengthens. Pupation takes place among the needles, in cracks on the stems, etc., and the moths emerge 5–34 days later. *Tricholyga bombycis,* Bech., four species of Ichneumonids, and *Pteromalus* sp. are parasitic in the larvae, the last-named sometimes killing about 60 per cent., and the eggs are attacked by two small species of Hymenoptera.

TAKAHASHI (R.). **Observations on the Coccidae of Formosa. Part II.** —*Rep. Dept. Agric. Govt. Res. Inst. Formosa,* no. 48, 45 pp., 22 figs., 7 refs. Taihoku, October 1930.

This second instalment [*cf. R.A.E.,* A, xvii, 567] contains descriptions of 16 Coccids attacking bamboo in Formosa of which 12 species and 2 varieties are new. Notes on some other new or little known species, including *Aclerda japonica,* Newst., on sugar-cane, which is new to the fauna, a supplementary list of food-plants and a list of some Coccids of the Loochoo Islands are also given.

CRESSMAN (A. W.) & DUMESTRE (J. O.). **The feeding Rate of the Australian Lady Beetle,** *Rodolia cardinalis.*—*J. Agric. Res.,* xli, no. 3, pp. 197–203, 5 figs., 7 refs. Washington, D.C., 1st August 1930.

An account is given of experiments in Louisiana to ascertain the conditions affecting the rate of feeding of adults of *Novius* (*Rodolia*) *cardinalis,* Muls., on *Icerya purchasi,* Mask.

The following is taken from authors' summary : The daily feeding rate was found to be a function of temperature, age, seasonal change, and sex. Both external and internal stimuli were involved, the

quantity of food consumed varying with the rate of egg production. The effect of temperature was indirect, operating through the response to thermal change of activities that condition feeding. A pronounced seasonal change was observed, the beetles feeding at an increased rate from May to August, inclusive, as compared with the rate from September to April. The effect of age was such that the quantity of food consumed is lowest during the first tenth of the life span, rises to a maximum during the third, then shows a slight decrease. No systematic change was noted in 11 successive broods reared in the laboratory, but a marked difference was found in a stock taken from the field. Observations made every four hours showed the periodic nature of the feeding process. These diurnal fluctuations were modified under constant light.

BAERG (W. J.), ISELY (D.) & SCHWARDT (H. H.). [**Report on Entomological Work, 1928-29.**]—*Bull. Arkansas Agric. Expt. Sta.* no. 246, pp. 50–53, 1 fig. Fayetteville, Ark., December 1929. [Recd. Sept. 1930.]

Unusually severe local outbreaks of *Monocesta coryli*, Say (great elm leaf-beetle) occurred on red elm (*Ulmus fulva*) in Arkansas during the summers of 1928 and 1929, many of the trees being completely defoliated. American elm (*U. americana*) and *Crataegus* may also be more or less severely infested. In 1929, the adults appeared during the last week in May and the first week in June. The eggs are laid on the lower surface of the leaves in batches of 20–80 after the females have fed for a period of 20–30 days. The larvae hatch in 15 or 16 days and pass through three instars, which average 5, 8–9 and 12–13 days respectively. About the end of July, they burrow into the soil where they remain throughout the winter. Some, however, may be found on the foliage as late as 10th September. Pupation occurs in the soil between 20th April and 20th May, at a depth of 2–6 ins., and the pupal period averages 18–19 days. The adults remain in the pupal cells for several days before emerging.

Serious annual injury to cotton by the boll weevil [*Anthonomus grandis*, Boh.] occurs over a comparatively small area during the growing season, the damage caused after the weevils disperse late in the summer being usually relatively light under average conditions. Some localities are subject to sporadic outbreaks in certain years. It was found that the weevil regularly occurs in fertile land bordered by well-drained hill-land favourable for hibernation. In such land, the plants usually form squares late in the season, in which the weevils are able to reproduce in large numbers before going into hibernation, and direct control is advisable. Although sandy hills are ideal hibernating quarters, the number of weevils that develop to go into hibernation is often comparatively small, since a drought in the late summer and autumn often checks the setting of the squares on cotton grown on light soil. Even when large numbers hibernate and a heavy infestation occurs in early summer, a period of hot dry weather may stop an infestation that appears to be well under way. On flat lands that are not well drained in winter, the weevils do not hibernate successfully except on knolls, etc. If the areas that require winter cleaning are not large, control of the weevil by destroying it in hibernation is recommended.

Silvanus (*Oryzaephilus*) *surinamensis*, L. (saw-toothed grain beetle) is a serious pest in rice mills. Observations indicate that polished rice is infested by adults only ; newly hatched larvae fed on this rice showed no evidence of growth and died within a few days. The immature stages are probably passed in the rice refuse, etc., in which larval development was completed in 11 days.

WALLACE (H. F.). **Boll Weevil and Plant Lice poisoning Work.**—*Bull. Mississippi Agric. Expt. Sta.*, no. 271, pp. 14–15. A. & M. College, Miss., December 1929. [Recd. Sept. 1930.]

In 1929, experiments were carried out in Mississippi to test the advisability of dusting cotton late in the season for the control of the boll weevil [*Anthonomus grandis*, Boh.] and Aphids. The dusts were applied on 9th August, when the weevil infestation on all plots had reached 100 per cent., and again on 16th August at the rate of 14 lb. per acre. Two dusts were used, one a mixture of 8 parts calcium arsenate and one part of a commercial mixture of nicotine sulphate and calcium arsenate, and the other a mixture of 2 parts calcium arsenate to one part tobacco dust. The dust containing nicotine sulphate resulted in an increased yield of 355 lb. per acre over the untreated plots and that containing tobacco dust 259 lb. Both forms of nicotine controlled Aphid infestation, and the treatments resulted in an increased profit equivalent to about £3 4*s*. per acre.

MACKIE (D. B.). **Some Insects infesting Shade Trees in California and the Problem involved in their Control.**—*Mon. Bull. Dept. Agric. California*, xix, no. 8, pp. 547–556, 2 figs. Sacramento, Cal., August 1930.

The insects affecting shade trees in California have not hitherto received much attention, as they have been merely a few native species of more or less sporadic occurrence. With the planting of fresh varieties of trees, however, and the introduction of several insect pests, there may at any time be considerable mortality among the street trees, particularly elms and planes. *Gossyparia spuria*, Mod. (European elm scale) is generally found in crowded colonies on the lower side of the limbs of elms, and the young crawl out on the current year's growth, forming the nucleus of new colonies. There is only one generation in a year, but much damage can be done before infestation is observed, the bark on the lower side of branches splitting off and dying so that the whole branch is killed and shoots frequently appear on the trunk. The trees should be inspected when they are leafless, and if infested should be sprayed with a mineral oil emulsion at 4 or 5 per cent. strength. The oil should have a viscosity of over 100, preferably 110 (Saybolt seconds), and should test not less than 60 to 65 unsulphonated residue. A strong stream of water will dislodge many of the young forms if applied when they are crawling about before attaching themselves to the tree.

Galerucella xanthomelaena, Schr. (European elm leaf beetle) has 4½ or 5 generations a year in California, as compared with only two in

the Atlantic Coast States, the life-cycle from egg to adult occupying 30–40 days. The adults that have hibernated feed for about 30 days before oviposition begins, devouring large portions of the leaves of elms. Eggs are laid on the lower surface of the leaves, a female depositing about 600, in batches of 4–20. The larvae hatch in 5 or 6 days and feed on the lower leaf surface, leaving the upper epidermis untouched. After feeding for 15 to 20 days they pupate in fissures of the bark or on the ground, the pupal stage lasting about 9 days. In cases of heavy infestation, no new foliage can develop, and consequent injury from the sun kills the tree in the second season if not in the first. When the adults emerge from hibernation, and before oviposition begins, they can be easily killed by a spray of 4 lb. acid lead arsenate in 100 U.S. gals. water.

Stomacoccus platani, Ferris (plane tree scale) is apparently a native Coccid that has spread from the native sycamore [*Platanus racemosa*] to the introduced oriental plane [*P. orientalis*], and has not received much attention. Infestation causes spots on the leaves, which eventually fall. The chief damage is done in early summer. The life-cycle and number of generations are not known. The small cottony egg-masses can be observed in crevices of the bark in early spring, and the spots appear on the foliage when the young have settled down to feed.

The most suitable apparatus and methods of spraying shade trees are described, and the essential points in organising a successful campaign and the probable costs are discussed.

Smith (R. H.). **Experiments with Paris Green in the Control of Termites.**—*Mon. Bull. Dept. Agric. California*, xix, no. 8, pp. 557–560, 2 figs., 3 refs. Sacramento, Cal., August 1930.

Experiments are described in which Paris green was injected by means of a de Vilbiss atomiser into the galleries of termites in timber. The conclusions reached are that it is apparently very effective against both *Calotermes* and *Reticulitermes*, but the results do not prove conclusively that the injection of the poison will kill the entire colony. If the infestation is limited, however, extermination can probably be effected in this manner. There is reason to believe that other poisons that are less dangerous to man might prove as successful as Paris green.

Steinweden (J. B.). **Characteristics of some of our California soft Scale Insects (Coccidae).**—*Mon. Bull. Dept. Agric. California*, xix, no. 8, pp. 561–571, 3 pls., 10 refs. Sacramento, Cal., August 1930.

Descriptions are given of the characters of six of the most important soft scales of California, most of which have proved difficult to determine accurately, *viz.*, *Coccus hesperidum*, L. (soft brown scale), *C. pseudomagnoliarum*, Kuw. (gray citrus or citricola scale), *Saissetia oleae*, Bern. (black scale), *S. coffeae*, Wlk. (*hemisphaerica*, Targ.), *S. nigra*, Nietn., and *Lecanium corni*, Bch. (brown apricot scale).

BORDEN (A. D.). **Notes on some Deciduous Fruit Insects.**—*Mon. Bull. Dept. Agric. California*, xix, no. 8, pp. 572–573. Sacramento, Cal., August 1930.

The weevil, *Stamoderes uniformis*, Casey, which is a native pest of willows, has recently been observed damaging apples in one district of California, eating out large pieces and spoiling the appearance of the fruit. The adults emerge from the ground in early March and climb up apple and pear trees to feed on the tender tips of the opening buds and the blossoms and young fruit, the damage being particularly severe in early June. Oviposition occurs in May and early June, a double row of black, cylindrical eggs appearing on the lower surface of the leaves. The larvae upon hatching drop to the ground and probably feed on the roots of the food-plant. There is only one generation in a year. The loss caused in 1928 varied from 30 to 60 per cent. of the crop, but in one orchard of 22 acres where it was over 50 per cent., tree banding combined with poison baits reduced it to one per cent. in 1929. The usual spray practices are ineffective.

The branch and twig borer, *Polycaon confertus*, Lec., was unusually troublesome on fruit trees in 1929 and 1930, damaging apples, pears and peaches. The open burrow in the twigs at the bud axil is easily recognised. *Hoplia pubicollis*, Lec., was injurious to the fruit buds of apple and pear, especially those of new grafts; leaf buds and blossoms were badly damaged on the smaller pear trees. *Nysius ericae*, Schill. (false chinch bug) was observed in early June over an area of 22 acres in an apple orchard. The insects, most of which were immature, had apparently been breeding on the cover crop, and, when it was ploughed, crawled over the ground in countless numbers and up the trees and fed on the foliage and fruit; 80 one-year-old apple trees were killed. The bugs breed in native grasses and cover crops and are always liable to migrate. In a similar outbreak in 1928, grape vines over an area of 6 acres were defoliated. Successful treatment was obtained in one instance by dusting with calcium cyanide, early in the morning.

McGREGOR (E. A.). **New Spider Mite reported in Tulare.**—*Mon. Bull. Dept. Agric. California*, xix, no. 8, p. 573. Sacramento, Cal., August 1930.

Paratetranychus pilosus var. *occidentalis*, McG. [*R.A.E.*, A, xvi, 440] has been found established in central California. It was discovered in December 1929, when it occurred chiefly in the over-wintering egg stage, enormous numbers being present on the branches and twigs of peaches. It is potentially of great economic importance.

KEIFER (H. H.). **Synopsis of the Dipterous Larvae found in California Fruits.**—*Mon. Bull. Dept. Agric. California*, xix, no. 8, pp. 574–581, 1 pl., 8 refs. Sacramento, Cal., August 1930.

Notes are given for the purpose of identification of the larvae of the Diptera found in Californian fruits. They include the Scatopsid, *Rhegmoclema atrata*, Say; the Phorid, *Aphiochaeta rufipes*, Mg.; the Syrphids, *Eumerus* spp. (lesser bulb flies); various Sarcophagids; the Muscids, *Musca domestica*, L., and *Muscina* spp.; the Anthomyiids, *Hylemyia* sp., *Eulimnophora arcuata*, Stein, and *Fannia* spp.; the

Ortalid, *Euxesta* sp.; the Lonchaeid, *Lonchaea occidentalis*, Mall.; the Drosophilids, *Drosophila melanogaster*, Mg., and *D. immigrans*, Sturt.; and the Trypetids, *Rhagoletis suavis completa*, Cress. (walnut husk fly) and *Epochra canadensis*, Lw. (currant fruit fly). These, except the last two, are all scavengers and only attack bruised or partly decayed fruit.

LOCKWOOD (S.). **The Grape Leaf Hopper in California.**—*Mon. Bull. Dept. Agric. California*, xix, no. 8, pp. 582–584. Sacramento, Cal., August 1930.

Erythroneura comes, Say (grape leafhopper) was far more injurious to grapes in California in 1930 than in previous years, damaging particularly the young leaves. The first apparent injury to vines is the silvery spots on the leaves; when these run together, the leaves begin to drop, thus exposing the young grapes to direct sunlight. This usually occurs about June or July, but in 1930 the leaves were falling by mid-May. Growth of the vines is retarded, and they enter the dormant period without sufficient vitality to start vigorous growth in the following year. The fruit also becomes speckled with excreta, which largely detracts from its market value. For many years the standard remedy for the leafhopper was spraying the lower surface of infested leaves with nicotine sulphate and fish-oil soap, but for large areas this has generally been superseded by calcium cyanide dust. For the spray, 1 U.S. quart of liquid soap or 2 lb. of hard soap and $\frac{3}{4}$–1 U.S. pint of 40 per cent. nicotine sulphate are diluted with water to make 100 U.S. gals. This should be applied when most of the nymphs of the first generation have hatched, and by that time the foliage is thick and spraying difficult. A petroleum oil spray is occasionally used, but is apt to damage the crop and destroy the bloom on the fruit, and causes injury to the leaves if sulphur is subsequently applied against mildew. Nicotine dusts appear to kill the nymphs more quickly than the adults, but the reverse is found when calcium cyanide is used. From 15 to 30 lb. of calcium cyanide have been used to the acre; 20 lb. should be sufficient if there is no air movement. If calcium cyanide has been applied when the air is slightly moving, an oil spray has been used on the soil under the vines to kill the hoppers that have been merely knocked down. Tests have been made which indicate that a mixture of two-thirds calcium cyanide dust and one-third granules is effective when applied at the rate of 25 lb. to the acre. The dust stupefies the hoppers, and the granules finally kill them. Such a mixture is, however, apt to clog the machine. A dust of even consistency but somewhat coarser than that now used would be desirable.

WRIGHT (P. F.). **Progress in the Control of the Grape Mealybug.**—*Mon. Bull. Dept. Agric. California*, xix, no. 8, pp. 588–590, 1 fig. Sacramento, Cal., August 1930.

Though several species of parasites and predators attack the grape mealybug, *Pseudococcus maritimus*, Ehrh., in California, their effectiveness is largely checked by ants. The heaviest infestations of the mealybug apparently occur where the Argentine ant [*Iridomyrmex humilis*, Mayr] is present, but this ant is found in very few vineyards, the more usual species being *Prenolepis imparis*, Say (honey ant).

Argentine ant syrup was ineffective against this ant, but a successful poison consisted of 10 pints distilled water in which ½ lb. thallium sulphate is dissolved by boiling; 10 lb. pure cane sugar is then added and the mixture boiled slowly for 20 minutes, 1½ lb. honey being added when cool. Cups containing this poison were placed under each vine, and those that had not attracted ants were moved each day, the others being refilled when necessary. In 3 days a whole colony was poisoned, the cost being negligible. The success of this method in heavy infestations has not, however, yet been proved.

Browne (A. C.) & Keifer (H. H.). **A Contribution to our Knowledge of** *Brachyrhinus cribricollis.—Mon. Bull. Dept. Agric. California,* xix, no. 8, pp. 591–595, 5 figs. Sacramento, Cal., August 1930.

Notes are given on the life-history of the early stages of the weevils. *Otiorrhynchus* (*Brachyrrhinus*) *cribricollis*, Gyll., and *O.* (*B.*) *rugosostriatus*, Goeze, which are frequently found associated in the soil in California, their economic status being as yet undetermined.

Rosen (H. R.). **Overwintering of the Fire Blight Pathogen,** *Bacillus amylovorus,* **within the Beehive.**—*Science,* lxxii, no. 1864, pp. 301–302, 7 refs. New York, N.Y., 19th September 1930.

Investigating the problem of the source of spring infection of fire blight in orchards in Arkansas, the author was successful in isolating *Bacillus amylovorus* from beehive material obtained during the summer, winter and early spring, and from the bees themselves obtained from the hives in the early spring prior to the development of the disease.

[Cleare (L. D.).] **Entomological Investigations.**—*Admin. Rep. Dir. Agric. Br. Guiana 1929,* pp. 16–17. Georgetown, Demerara, 1930.

It is estimated that over 90 per cent. of the stalks of sugar-cane in British Guiana are injured to the extent of 25 per cent. of their joints by *Diatraea* spp. During the mid-year and the rainy season of 1929, sugar-cane and the fairways of a golf course were infested by *Dyscinetus geminatus*, F., and *D. bidentatus*, Burm. These pests appear to live in waste grass-land and periodically cause considerable damage to sugar-cane. Flooding is recommended as a control measure. *Mormidea poecila*, Dall., and *Diatraea saccharalis*, F., infested rice. The life-cycle of *Castnia daedalus*, Cram. (coconut stem borer) was found to last about a year.

Monte (O.). **Uma praga do quiabeiro,** *Antarctia fusca,* **Walk.** [*A. fusca*, a Pest of *Hibiscus esculentus*.]—*Chacaras e Quintaes,* xlii, no. 2, pp. 145–146, 2 figs. S. Paulo, 15th August 1930.

The Arctiid, *Antarctia fusca*, Wlk., is recorded as attacking the leaves of *Hibiscus esculentus* in Brazil. The eggs are laid on the lower surface of the leaves, and the larval and pupal stages last about 40 and 20 days respectively. In the case of small plots the eggs may be collected, otherwise Paris green should be dusted on the leaves.

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Aphis, Cabbage (see *Brevicoryne brassicae*).
Aphis, Geranium (see *Macrosiphum cornelli*).
Aphis, Green Apple (see *Aphis pomi*).

* In view of the divergent opinions on the identity of the Aphids of this group, no attempt is here made to show the synonymy.

Aphis, Green Citrus (see *Aphis spiraecola*).
Aphis, Green Peach (see *Myzus persicae*).
Aphis, Hickory Leaf (see *Myzocallis fumipennellus*).
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